

scarcely any dense black, while the hind legs are slightly tawny with clear markings of black and white. The whole skin is very handsome and remarkable. The specimen was caught by a native in a trap and then shot. The native took the tip of the tail and the claws for trophies. It was caught about twenty miles from Graham's-town. I have made many inquiries respecting this peculiar variety with the hope of forming some good theory explaining this deviation from the ordinary type. I can only trace four specimens, viz. :—The skin in the Graham's-town Museum (this is a good specimen, but not nearly so black as the one in my possession); another was taken to England by Mr. Bowker, and is in the British Museum; a third was sold some time ago at a Church bazaar, but I cannot trace it; and the fourth I have. I do not know of any other for certain. All these have been shot in, or about the same district. The one I have came from Collingham near to Graham's-town. I am told that there are two living specimens still in the district, and there may be more, but these two have been seen, but not captured. I am still on the trail for more information; at present I cannot give any certain or probable account of the origin of this variety, but I write this to you and shall be glad to forward you further information when I have completed my investigation.

“I remain, dear Sir,
Yours sincerely,
(Signed) NENDICK ABRAHAM,
Pres. Graham's-town Natural History Society.”

April 20, 1886.

Prof. Flower, LL.D., F.R.S., President, in the Chair.

Mr. O. Salvin, F.R.S., exhibited a living specimen of an exotic Worm—*Bipalium kewense* (Moseley, Ann. & Mag. N. H. ser. 5, vol. i. p. 238), found at Hawksfold, Fernhurst, April 19, 1886, amongst the broken tiles at the bottom of a pot of *Calceolaria*, which had been in a cold frame the whole winter. This fact suggested that the true home of *B. kewense* was some temperate region.

The following extract was read from a letter addressed by Mr. R. A. Sterndale, F.Z.S., to Sir Victor Brooke, concerning a case of hybridism between *Ovis hodgsoni* and *O. vignei* :—

“In the mountain-range south of the Indus, near Lanskar (the precise locality being for obvious reasons withheld from publication), a herd of *Ovis vignei* were observed for some years to contain a large ram of *Ovis hodgsoni*, who drove out the weaker Shapoo rams and appropriated the ewes of the herd. The ram was ultimately, one winter, killed and eaten by Chankos or Tibetan wolves; but during his stay he produced a family of hybrids possessing greater size of horn and head, with characteristic colouring combining traits

of both animals. In course of time these hybrids were crossed again with *Ovis vignei*, and the third generation shows signs of degeneration from the larger sheep and of reversion to the type of *O. vignei*.

"The skull of the half-bred animals, which the Tartars called Nyan Shapoo, the former being the name of the *Ovis hodgsoni* or Ammon, and the latter that of the *Ovis vignei*, is nearer in size to *Ovis hodgsoni*, which is double that of the other. The horns of these hybrids are rounded in front, resembling what has been figured of *Ovis brookei*, but hollowed out behind like those of *O. vignei*. The horns of the quarter-bred animal are square in front and hollowed behind like the true Shapoo-type, but are more massive than the pure-bred Shapoo.

"Now as regards the colour of the skin, the Nyan or *Ovis hodgsoni* has no black beard or throat-stripe, which *O. vignei* has. The half-bred animal shows no black, but the quarter-bred does in a modified but decided degree. The half-bred turns also in summer to the colour of *O. hodgsoni*, having more of a blue-grey or lavender tint and less of the fawn colour of *O. vignei*; with the white throat of *O. hodgsoni*, it also gets the dark patch at the side of the neck. The skin of a quarter-bred specimen before me is of a bright fawn above, sides and rump white, and a black stripe down the middle of the throat."

Sir Victor Brooke was of opinion that *Ovis brookei*, Ward, P. Z. S. 1874, p. 143, was probably established on a somewhat similar hybrid.

The following papers were read:—

1. On some Specimens of Disease from Mammals in the Society's Gardens. By J. BLAND SUTTON, F.R.C.S., Erasmus Wilson Lecturer on Pathology, Royal College of Surgeons, Lecturer and Assistant Surgeon to the Middlesex Hospital.

[Received March 30, 1886.]

During the past twelve months several specimens illustrating diseases of mammals in the Society's Gardens have come to hand. Some of them present features of such exceptional interest that it is desirable they should be placed on record. Of the value of the systematic examination of the bodies of wild animals dying in the Society's Gardens there can be no doubt whatever—not in the sense that it will enable us to deal with diseases occurring in them, but in the amount of light likely to accrue to pathological science in general if the investigation be carried on with the diligence and care its importance demands. The specimens to be described in this paper are of value, inasmuch as many of them are somewhat rare in

their nature, whilst others illustrate pathological conditions not before described in wild animals.

In 1877 Mr. Garrod read a short paper before this Society "On the Mechanism of the Intervertebral Substance, and on some Effects of the Erect Position of Man" (P. Z. S. 1877, p. 50) from which the following extract has been taken:—

"The assumption of a vertical attitude by a creature originally differentiated for a horizontal position of its body, has produced but marvellously slight inconvenience. If it had resulted in many, man could scarcely have survived. There are one or two, however, which are most clearly traceable to this cause, including the painful tendency to prolapse, antifixion, and retroflexion of the uterus in women, as well as crural hernia in both sexes, and inguinal hernia in the male."

At the time the preceding paragraph was written, little was known, and far less recorded, concerning the abnormal conditions referred to by Mr. Garrod. The unusual opportunities which have occurred to me during the past five years of investigating diseases of wild animals will render necessary a reconsideration of this opinion.

In the first place prolapse of the uterus occurs with tolerable frequency, not only in domesticated mammals, but in the lioness, tapir, Cape hunting-dog, the pygmy hog, deer, antelope, and others. These examples are sufficient to show that it is not entirely attributable to the erect position.

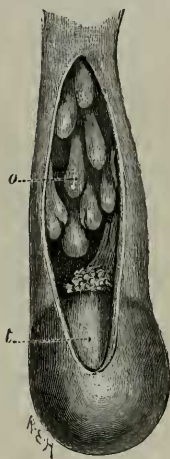
With regard to flexions of the uterus, it is a remarkable fact that no fewer than one fourth of all the female Monkeys dying during the past two years presented extreme examples of this abnormal condition of the organ. In many the displacement far exceeded anything that I have seen in the human female. Well marked specimens of flexion of the uterus occur also in Deer. (For a detailed account of these cases and their ætiology consult Path. Soc. Trans. vol. xxxvi. p. 502.) The frequency and severity of the cases show that the flexion is due to causes in addition to the erect position.

Concerning hernia, it has always seemed to me strange that Man, whose inguinal canals are, in the ordinary course of events, more or less obliterated, should be so liable to visceral protrusions at these spots, whilst Monkeys, in whom the inguinal canals in most species remain more or less patent, should escape. It is certain that Horses are liable to inguinal ruptures; and I have long known that the same defect occurs with tolerable frequency in Sheep. During the past two months I have been so fortunate as to meet with two cases of inguinal hernia in Monkeys. In the first, *Macacus cyclopis*, a large plug of omentum occupied the funicular pouch of the left side; the second occurred on the right side in a *Macacus sinicus*. The details of the condition may be gathered from fig. 1, p. 208. This Monkey had also a large varicocele on the left side. These specimens are sufficient to show that such abnormalities are not peculiar to Man.

Probably most individuals among the civilized races of mankind

suffer at some period of their life from those troublesome thickenings of the skin of the feet and toes known as corns. Structurally a corn consists of thickening of the epidermis, due to pressure of an intermittent character, often the result of badly fitting boots. In many cases a small sac containing fluid may be detected between the thickened epidermis and the deeper tissues; this sac is technically termed a bursa. In others the bursa is replaced by loose connective tissue which allows the corn to glide freely over the underlying structures. We find excellent examples of corns in the ischial callosities of the *Cynomorpha* and in the callous pads found on the feet of Carnivora.

Fig. 1.



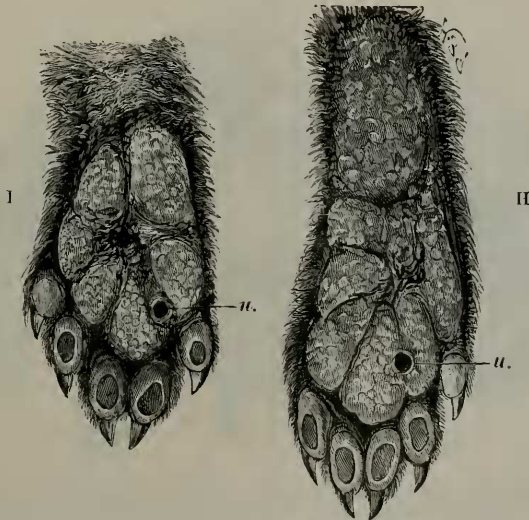
The right funicular pouch of peritoneum of *Macacus sinicus*, occupied by a plug of omentum, *o*; the testis, *t*.

Of late years the attention of surgeons has been directed to corns, in consequence of a very remarkable affection to which they are liable. Under certain abnormal conditions of the spinal cord and peripheral nerves, such as locomotor ataxy, sclerosis, and peripheral neuritis, the corns ulcerate, and at last the ulceration perforates not merely the corn, but the whole thickness of the foot; hence it is now familiar as the "perforating ulcer."

It was to me a matter of no small interest to find the callous pad on the foot of a Civet Cat the seat of a perforating ulcer; the interest was considerably heightened when, on opening the spinal

canal, the cord was found soft and almost diffuent. By careful hardening and manipulation, sections were obtained from the cord and submitted to the microscope. It exhibited a most marked degree of sclerosis. This was also seen in the nerves of the affected limb. The animal was supposed to be about seven years of age, and had been paralyzed for some time before it died. The specimen was shown to a number of experts, who were unanimous as to the nature of the affection, viz. perforating ulcer, with sclerosis of the cord and nerves. I then ventured the opinion that more cases would come to hand. A few weeks later a second specimen came under my observation, also in a Civet Cat; and, lastly, a most interesting example in the Two-spotted Paradoxure (*Nandinia binotata*). In the case of the Paradoxure the affection of the callous pads is in an early stage, for the ulcers, one on each foot, are as yet shallow (fig. 2).

Fig. 2.



Perforating ulcers (*u*) in an early stage affecting the feet of a Paradoxure, *Nandinia binotata*, secondary to sclerosis of the spinal cord. The ulcers were perfectly symmetrical on the fore and hind feet.

F, the fore, and H, the hind foot.

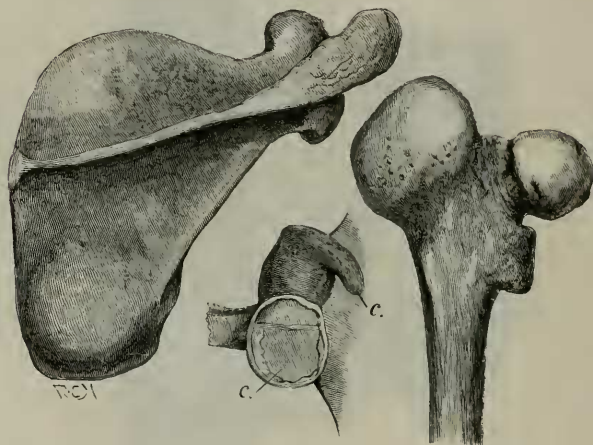
The most remarkable feature in the specimen is the perfect symmetry observed in the ulcers; in each fore foot the position and shape of the sores correspond exactly, and this is also to be observed in the hind feet. In this case only the lumbar and anterior portion of the spinal cord could be examined; for, after the animal died, its companion, much to my annoyance, had eaten the middle portion of its

back. However, an examination of such pieces of the cord as remained showed well-marked and indisputable sclerotic changes.

In 1842 Sir James Paget and Dr. William Budd¹ almost simultaneously directed attention to the frequent symmetry exhibited by disease of the tissues of the body. For example, an eruption on the skin of one leg is occasionally imitated by an eruption on the opposite leg, symmetrical, not only in position, but often in the shape of the patch, in the grouping, and even in the number of spots in each group. This symmetry is not merely confined to skin eruptions, but to diseases of the joints, sense-organs, nerves, bones, tumours, &c. Examples of symmetry occur very frequently in animals as a result of disease; and the following cases will serve as striking instances.

In the accompanying drawings (fig. 3) will be seen the scapula

Fig. 3.



Examples of symmetrical exostoses (*c*) in the skeleton of a Monkey, affecting the scapula, great trochanter, and coracoid process. The tumours on the opposite side were exactly similar in shape and situation, and nearly equal in size.

and femur of a Bonnet-Monkey that died of bronchitis complicating rickets. The inferior angle of the scapula is occupied by an osseous tumour containing tracts of cartilage. The base of the coracoid process presents a rounded projection, which would probably have grown into a tumour had the Monkey lived. The great trochanter of the femur presents also a rounded tumour similar to that of the scapula, but containing less cartilage. Each humerus presented a

¹ Med.-Chir. Trans. vol. xxv.

curious deformity, for at the junction of the upper and middle third the shaft was bent almost at a right angle. The corresponding bones of the opposite side presented precisely similar lesions.

The sebaceous glands of the skin very frequently in the human subject suffer obstruction of their excretory duct. The result is that the gland continues to secrete, but the outlet being closed, the sebaceous matter accumulates until at last a definite swelling results, which may remain of insignificant proportions, or attain a diameter of two or three inches in exceptional cases. Technically such swellings form one of a group known as "retention cysts."

The museum of the Royal College of Surgeons possesses some specimens of symmetrical sebaceous cysts growing from the wings of Wood-Pigeons. The specimens were presented by Mr. Tegetmeier. It appears that in certain seasons a large number of birds are found with swellings such as these on the wings, legs, and feet.

Fig. 4.



A Cockateel, *Calopsitta novaehollandiae*, with symmetrical sebaceous cysts on its wings.

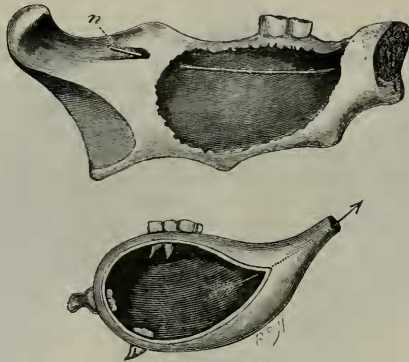
An excellent example of this affection has recently come under my notice in a Cockateel, *Calopsitta novaehollandiae*. In this pretty bird there has developed on the inner surface of each wing a sebaceous cyst. The position, size, and shape of the "swelling" in the two cases exactly correspond, as may be seen on reference to the drawing (fig. 4). The specimen serves as an excellent illustration of symmetrical disease.

Malformations are frequently as symmetrical as tumours and skin eruptions. Mr. Forbes has recorded in the 'Proceedings' of this Society (1882, p. 442) an example of webbed fingers in a *Pithecia satanas*. "The third and fourth digits of the manus on each side were completely connected down to their tips by a fold of nude skin, with their nails closely apposed, though not connected, along their

contiguous margins; the remaining digits were normal." I remember examining the specimen, at the time Mr. Forbes noticed it, in the Prosector's room, and was impressed with the perfect symmetry of the malformation.

Since then one other example of malformation in the manus of a Monkey has occurred. A Gibbon (*Hylobates leuciscus*), which lived in the Gardens a few months, was found to have a supernumerary finger on each hand. In this case the additional fingers possess a metacarpal bone which was attached to the ulnar side of the metacarpal of the fifth digit, and it seems as though the supernumerary bone was formed as a result of bifurcation of the distal end of the fifth one. The carpal bones do not present any abnormality. So few examples of polydactyly in *Quadrumana* have been noticed that the case before us is worthy of record.

Fig. 5.



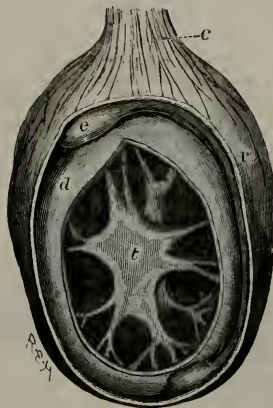
A follicular cyst from a Prehensile-tail Porcupine, *Sphingurus prehensilis*. The upper figure represents the jaw after the removal of the cyst. *n*, the inferior dental nerve. The lower drawing is the cyst with the teeth projecting into it. The arrow marks the position of the mental foramen.

As an additional illustration of symmetry in disease, the following case is of value. A Prehensile-tailed Porcupine died from the effects of a large abscess on each side of the mouth. These had burst externally, giving rise to deep sinuses. A probe passed into each gave evidence of necrosed bone; and at first sight the case seemed to be one of alveolar abscess consequent upon diseased teeth, a condition of things exceedingly common in animals. On examining the mouth I failed to find the lower incisors; this was very singular, because the bone at the symphysis was quite normal. On tracing one of the sinuses by dissection, it was found to lead into the mental foramen, and thence into a cavity occupying the body of

the inferior maxilla. This cavity was filled with pus, but the abscess was limited by fibrous walls of considerable thickness. Feeling convinced that this was something more than a simple abscess, the bony walls were dissected and the sac removed and examined in detail.

This cyst is represented of natural size in fig. 5. Projecting into its posterior aspect are portions of the fangs of two undeveloped teeth. This is sufficient evidence to show that we have to deal with a follicular cyst—that is, the walls of this sac are constituted by the greatly distended follicle of one of the teeth, probably the incisor. From some cause or other suppuration had occurred, and led to the necrosis of the maxilla and absorption of the fangs of the

Fig. 6.



The tunica vaginalis and testis of a Lamb affected with a congenital parenchymatous hydrocele.

e, cremaster; *d*, tunica albuginea; *e*, epididymis; *t*, secreting-tissue of the testis.

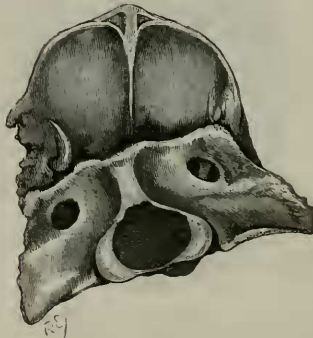
molar teeth: a remnant of one may be seen projecting into the cyst. The inferior dental nerve, as a mere thread, was closely embedded in the walls of the jaw on the outer side of the sac. The opposite maxilla was affected in a precisely similar manner.

The last example of symmetrical disease I shall describe in this communication is a singular affection of the testes of a Lamb, which, so far as my knowledge of testicular disease extends, is unique. The lamb was thought to be ruptured on both sides, but on cutting into the supposed hernial sac a large quantity of fluid escaped, but no gut or omentum were found. The remaining testis was removed entire with its coverings and sent to me. The enormously distended outer covering (fig. 6) is the tunica vaginalis and testis cut off

from its connection with the peritoneal cavity. A few fibres of the cremaster muscle are spread over its upper limits. Inside this, and in close apposition with its walls, is the tunica albuginea, greatly distended, with the epididymis stretched over it like a strap. On cutting into it, a pint of straw-coloured fluid escaped. This liquid was alkaline in reaction (sp. gr. 1020), and contained one half its volume of albumen.

The substance of the testicle presented a very remarkable appearance, for it looked like the roots of a tree in miniature. There was a central main stem, and from it slender rounded rootlets composed of testicular substance, *i. e.* seminiferous tubules and connective tissue, passed outwards to the sac-walls. The appearances were the same in both testes. The condition is best expressed by saying that it resembled a hydrocele, except that the fluid was within the tunica albuginea instead of in the cavity of the tunica vaginalis.

Fig. 7.



The occiput of an Ichneumon, with dislocation of the atlas and subsequent ankylosis of that bone to the occiput.

The specimen has been brought before the notice of the Society, with the hope of inducing others who have opportunities of seeing similar cases to place a description of them on record.

In 1879 Prof. Flower gave an account of a very remarkable condition presented by the occiput of a Beluga. In this Whale the atlas had become dislocated from the occipital condyles, and displaced in such a manner that the passage for the spinal cord at the foramen magnum had become reduced to a very narrow chink, only three quarters of an inch in transverse measurement. The Whale had survived the accident some considerable time, for the displaced

atlas had become firmly ankylosed to the occiput, and it is very curious that the animal could have survived so serious an accident.

A somewhat similar case came under observation in an Ichneumon. In this instance the atlas had been dislocated from its relations to the occiput and axis, so as to occupy the situation shown in the accompanying drawing (fig. 7). In this instance the animal must have survived the injury a long time, because the occiput and atlas are firmly united by new bone.

Concretions formed of insoluble or indigestible matters are of frequent occurrence in the alimentary canal of Horses and Cattle, and at times may attain to very large size without causing any inconvenience. This is more particularly the case when these ægropiles, as they are termed, occur in the cæcum of horses. In this situation they have been known to weigh more than fifty pounds. These heavier masses are composed of magnesium phosphates; the lighter ones consist of hair which the animal licks from its body. This form is fairly frequent in calves, and I have met with a specimen in a Hyæna. Concretions of insoluble substances, such as magnesia, pins, seeds, &c., occur also in the human subject. Recently a Tiger died in the Gardens, and its bowels were found empty until the rectum was reached. Here a large mass of solid material was found about two inches from the anus, measuring six inches in length and eight inches in girth, covered with mucus. The lower end was bluntly pointed, and had caused by its pressure ulceration of the mucous membrane. The rectum was much dilated. On breaking into the mass it was found to be composed entirely of sawdust, which the animal had licked from the floor of the cage. A cast of the abnormal mass was taken at the time by the assistant, Mr. Ockenden.

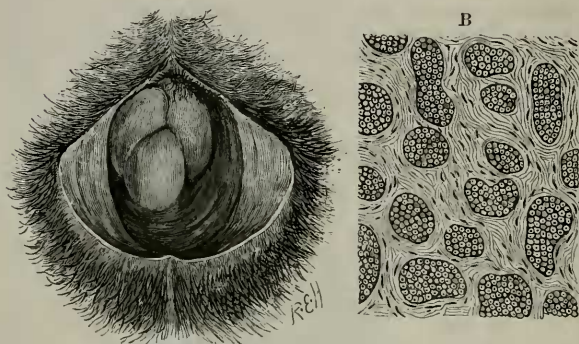
During the past four or five years there is one fact more than any other which has impressed me in the course of my work at the Gardens, and that is the infrequency of neoplasms. In the many hundreds of animals coming under observation, a tumour has been a rarity, and this applies with still greater force to cancers. The only example of this terrible malady I have seen in *wild* animals was a medullary cancer in the viscera of a Python. The infrequency of these growths makes the following case additionally interesting.

A Short-headed Phalanger, *Belideus breviceps*, was found to have a large, hard nodular mass in its marsupium. On slitting open the pouch a tumour presented itself, having the appearance represented in fig. 8, p. 216. Microscopically it presented all the characters peculiar to scirrhus cancer as seen in the human subject—that is, there were alveolar spaces enclosing masses of cells. The alveolar walls were composed of dense fibrous tissue. The structural details of the growth coincided with that of the gland from which it originated, except that the cells, instead of clothing the walls of the alveoli in a regular manner, were tumbled in confusion into the interior. This case is, so far as I know, the first authentic example of cancer in a marsupial.

The last specimen on my list is perhaps as interesting as any. It is an intussusception of the ileum into the cæcum, through, but not

carrying with it, the ileo-cæcal valve (see fig. 9, p. 217). The invaginated portion measures two and a half inches. The portion of gut above the constricted portion was very congested and almost gangrenous. The intussusception was very acute, and probably killed the animal, a Lemur, very quickly. The case is further interesting, for the intussusception occurred at that part of the intestine which

Fig. 8.



The marsupium of a Short-headed Phalanger, *Belidius breviceps*, opened in order to show a scirrhus cancer growing from the mammary gland.

The microscopic characters of the growth are shown in figure B.

is most frequently affected in this way in the human subject; but it is an example of the rarer form that occurs in this situation, viz. the ileo-cæcal variety.

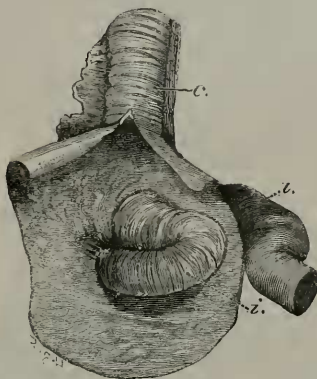
The investigation into disease, structural aberrations, and malformations of animals is of considerable importance apart from its intrinsic interest. Darwin, in his 'Descent of Man,' 2nd ed., 1874, page 6, writes:—"Man is liable to receive from the lower animals, and to communicate to them, certain diseases, as hydrophobia, variola, glanders, syphilis, cholera, herpes, etc.; and this fact proves the close similarity of their tissues and blood, both in minute structure and composition, far more plainly than does their comparison under the best microscope or by the aid of the best chemical analysis." He then quotes Rengger to the effect that the *Cebus azaræ* in its native land is liable to catarrh, apoplexy, inflammation of the bowels, and cataract.

This quotation seems to indicate beyond doubt that, had sufficient evidence been forthcoming regarding diseases of animals, Darwin

would most certainly have taken them into account as arguments in favour of his doctrine of Evolution.

So far as my own observations have extended, and each month adds new facts, there seem to be few forms of disease peculiar to

Fig. 9.



Ileo-caecal intussusception in a Lemur. *c.*, colon; *i.*, ileum.

Man. On the other hand, certain affections occur in some animals with much greater frequency than in him, whilst a few diseases are entirely confined to them; many are also modified by peculiarity in structure, mode of life, and environment of the affected animal.

2. On a new Species of Wild Pig from New Guinea.

By DR. O. FINSCH, C.M.Z.S. &c.

[Received March 22, 1886.]

The second species of true *Sus* from New Guinea is a very distinct one, and may be separated at once from the well-known *Sus papuensis* by the following characters:—

SUS NIGER, sp. nov.

Uniform blackish, even when young.

These characters are sufficient, in all ages, to separate the present species from *Sus papuensis*, which is quite different, being in the adult brown, with a very distinct light-coloured mystacial stripe and legs, while the young is rusty brown with light rusty-yellow stripes, as in our Wild Boar.

I was fortunate enough to bring home living examples of both these species, which are now deposited in the Zoological Gardens at Berlin. The specimen of *Sus papuensis* was obtained in the month of May, on the north coast of New Guinea, near the place noted on the charts "Passir Point," a point, however, which does not really exist; it was then striped, but has now changed to the coloration of the adult animal. The Black Pig (*Sus niger*) I purchased at Hihiaura, a village some miles east of Bentley Bay; it was then very young (perhaps six weeks old), and of a uniform black colour, which it still retains.

Sus niger is scarcer than *Sus papuensis*, but lives in the same localities; it is of a more slender figure, higher on its legs and has a much longer head. It grows to a considerable size, and I have seen very huge animals of this species.

I have observed *Sus niger* in a domesticated or semidomesticated state everywhere I have been in New Guinea along the south-east coast, and on the north-east coast from Milne Bay to Humboldt Bay, but always less common than *Sus papuensis*. The natives catch the young ones and feed them; they are pets of the women and often nursed at their breasts, and get very tame. This is the reason why it is so difficult to get them. I have seen some very large specimens in Hood-Bay district (village Kerapuno). Along the north-east coast I saw this species in all the native villages, especially in Chads Bay, in Village Island west of Fortification Point, in Astrolabe Bay, and in Humboldt Bay. It may be mentioned that along this coast I never saw any imported domestic pigs, but such pigs have been introduced into the Port-Moresby district and other places where missionaries have been sent.

The only specimen of *Sus niger* in a Museum that I know of is a young one in the Museum of the Hon. William MacLeay of Sydney.

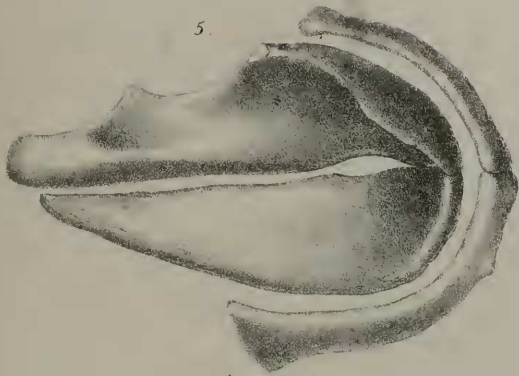
3. On the Relations of the Mandibular and Hyoid Arches in a Cretaceous Shark (*Hybodus dubrisiensis*, Mackie).
By A. SMITH WOODWARD, F.G.S., of the British Museum (Natural History). (Communicated by the Secretary.)

[Received March 23, 1886.]

(Plate XX.)

Exactly as in all other divisions of the Animal Kingdom, the rapid accumulation of morphological facts regarding the Selachian order is providing a sure basis for distinguishing the more archaic from the decidedly modern types. There can be no longer any doubt, for example, that among living Selachians the most primitive and ancient forms are the Notidanidæ, the Cestraciantidæ, and the Chlamydoselachidæ. And of all the characters by which these groups are definitely marked off from the remaining members of the Order, none are of greater interest and importance than those relating

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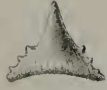
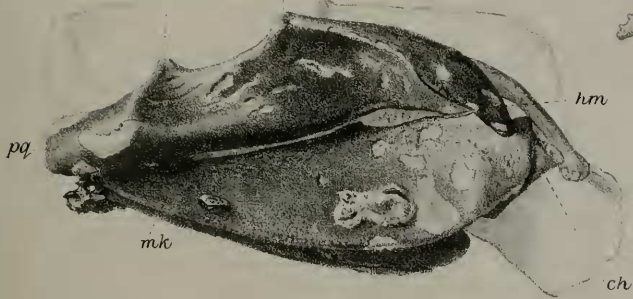
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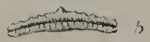
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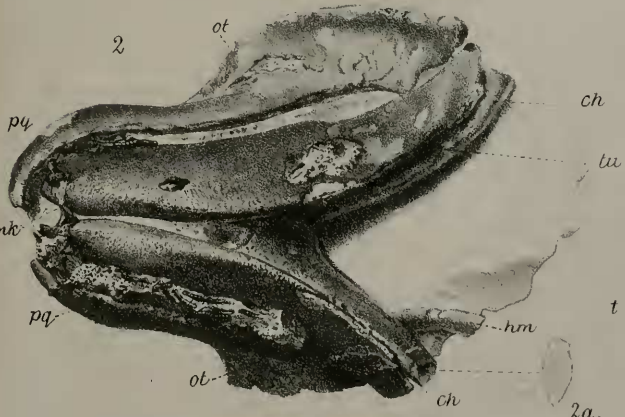
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t

2a.

to the cranium and the cartilages of the visceral arches. Employing the terminology of Prof. Huxley, published in this Society's 'Proceedings' for 1876¹, it may be said that the skull in each of the three families just mentioned exhibits a nearer approach to the primitive amphistylic type than does that of any other adult living vertebrate, the hyomandibular taking very little share in the support of the mandibular arch, and the union of that arch by direct articulation with the cranium being only slight and sometimes almost wanting. The superinduced modifications in the Notidanidæ and Cestraciontidæ are very evidently in the direction of an autostylic arrangement—the former having a postorbital articulation of the pterygoquadrate, and the latter a more extensive preorbital connection; and in the Chlamydoselachidæ there are somewhat similar tendencies, although the great extension of the pterygoquadrate cartilage beyond the chondrocranium has apparently rendered the hyomandibular support of some importance. It would seem, in fact, that the oldest representatives of the Selachian order had skulls which were neither hyostylic nor autostylic, though their least altered descendants incline rather to the latter type; and that *Notidanus* and *Cestracion* especially, with *Chlamydoselachus* in a less degree, afford some slight glimpse into the early condition of the mandibular and hyoid arches from which the two later modifications have developed.

Such being the conclusions based upon a study of living Selachians, it becomes of especial interest to determine to what extent they are confirmed or otherwise by the evidence of fossils. The remains of Sharks, Rays, and Chimæroids are abundantly scattered throughout most marine formations, from the Devonian to the latest Tertiary, and the biologist might thus be led to expect considerable information from this field of research. Unfortunately, however, "the imperfection of the geological record" presents its accustomed difficulties, and almost all the facts hitherto discovered relate merely to such hard structures as spines and teeth. There are also a few instances in which the entire fish has been described in a general way; but Prof. Cope's elaborate account² of some cranial fossils from the Permian of Texas appears to be the only contribution of importance that has yet been made to the morphology of the skull. Under such circumstances, I venture to offer to the Zoological Society a brief description of a Cretaceous fossil in the British Museum, which is particularly remarkable from the similarity of the archaic features it presents to those of the existing types already mentioned.

The fossil in question (no. 41675 of the B.M. register) was

¹ T. H. Huxley, "On the *Ceratodus forsteri*, with observations on the Classification of Fishes," Proc. Zool. Soc. 1876, pp. 40-45.

² E. D. Cope, "On the Structure of the Skull in the Elasmobranch genus *Didymodus*," Proc. Amer. Phil. Soc. vol. xxi. (1884), pp. 572-590, with plate. See also further remarks by S. Garman, "*Chlamydoselachus anguineus*, Garm., a living species of Cladodont Shark," Bull. Mus. Comp. Zool. Harvard Coll. vol. xii. no. 1 (1885), pp. 28, 29.

obtained from the Chalk of Kent, and is in an excellent state of preservation. It agrees in all important respects with a less perfect specimen in the same collection, which forms the type of *Hybodus dubrisiensis*, Mackie¹—this fossil having been placed with the Hybodonts in the Museum series by Mr. William Davies, and subsequently figured by the editor of the 'Geologist' under the name just quoted. And it may be added that the teeth are undistinguishable in general character from those of the typical species of *Hybodus* of earlier date. The specimen (Plate XX.) exhibits the pterygo-quadrate and Meckelian cartilages of each side,² those on the right, however, being broken away for about the hinder third; on the left side, the two elements of the hyoid arch are well shown in their natural position, and less complete remains of the corresponding cartilages are also seen on the right. Teeth and shagreen granules are abundant, and three well-calcified vertebrae appear at the back.

The *pterygo-quadrate* cartilage (figs. 1, 2, *pq*) measures 0.073 m. in length, and varies considerably in depth at different points. At the anterior end it is comparatively low and somewhat folded inwards above, but it soon begins to deepen by the rising of the upper border, which rapidly ascends to form a pterygo-trabecular process (*p*); this is placed at about one third of the distance from the fore to the hinder extremity. The process is almost pointed, and posteriorly the upper contour at once falls again to some extent, though soon re-ascending in the form of a gentle curve to a still higher prominence (*ot*), which exhibits in front a very distinct, relatively broad articular facette. This occurs at about the end of the second third of the cartilage, and thus far the characters are shown on both the left and right sides of the fossil; but the hindermost third is only preserved to the left. A little beyond the summit of the facette, the upper border becomes thickened and turned outwards, and its edge forms a regular gentle curve down to the articulation of the lower jaw. The inferior border of the cartilage is almost straight for its anterior two thirds, the denticigerous portion, and then there follows a curved hollowing; next is a minute process, marking the commencement of the articular portion, which shows two small hollowings and a terminal convex condyle.

The *Meckelian* cartilage, or lower jaw (*mk*), is preserved on both sides of the fossil, but is only perfect on the left. It measures 0.0685 m. in total length, being thus somewhat shorter than the pterygo-quadrate. The upper contour is almost straight from end to end, only a slight hollowing being perceptible immediately beyond the termination of the tooth-bearing portion; and this is succeeded by a short, wavy articular edge, fitting into the corresponding irregularities at the hinder end of the pterygo-quadrate, and finally presenting a distinct concavity for the reception of the upper condyle. The cartilage is deepest just beneath the end of the denticigerous portion, from which point the lower border curves upwards both in front and behind; posteriorly the curve is at first

¹ S. J. Mackie, "On a new Species of *Hybodus* from the Lower Chalk," 'The Geologist,' vol. vi. (1863), pp. 241-246, pl. xiii.

gradual, but then very abrupt, while anteriorly the rise is much more uniform and produces a markedly tapering outline. Quite at the front, the cartilage has the appearance of being more robust than is the case further back; but this is perhaps chiefly due to the infolding of the lower edge for the production of a trough for the membrane bearing the undeveloped teeth.

On comparing this form of mandibular arch with the various modifications observed among living Selachians, it is at once evident that none agrees so closely as that of the two genera of Notidanidæ. *Heptanchus* and *Hexanchus*¹, indeed, exhibit an arrangement that differs in no essential particular from that just described in the Cretaceous Hybodont. In both cases there is not only a well-developed pterygo-trabecular process—homologous (as shown by Prof. Huxley²) with the pedicle of the tadpole's suspensorium,—but also a distinct postorbital prominence and articulation, corresponding to the otic process in the tadpole³. The mode of articulation of the lower jaw is also nearly identical in each case; and though the fossil is at present much crushed, it requires very little careful study to discover that the hollows for the muscles for raising the mandible were quite as deep in the Cretaceous Shark as they are in the living genera under comparison; the upper border of the quadrate region, however, is much less thickened than in the Notidanidæ and agrees more closely with that of ordinary Selachians.

In the hyoid arch, the upper or *hyomandibular* element (figs. 1, 2, *hm*, and fig. 4) is comparatively small and slender. Its length is 0.037 m., and the cartilage is considerably arched and flattened in what appears to have been an antero-posterior direction. The proximal extremity is imperfect, but was evidently somewhat expanded at its articulation with the cranium; this end is also slightly twisted with respect to the axis of the rest of the element. Just below the bend, the cartilage appears contracted a little when viewed from behind, but soon expands again, forming a blunt tuberosity (*t*) on the side nearest the pterygo-quadrate; and from this point it finally becomes gradually narrowed until its termination in the imperfectly-displayed articulation for the cerato-hyal.

The *cerato-hyal* (figs. 1, 2, *ch*) is 0.048 m. in length, and is completely shown on the left side of the fossil, though somewhat mutilated at the distal end; the lower part, however, is well preserved on the right. The cartilage is considerably arched in the ordinary manner, and is much less robust towards its upper end than in the rest of its length. Compared with the hyomandibular, it is remarkably stout. A little below the proximal end it becomes comparatively large and

¹ See figures by C. Gegenbaur, "Untersuchungen zur vergleichenden Anatomie der Wirbelthiere.—III. Das Kopskelet der Selachier," pl. x. I am also indebted to the kindness of Mr. Howes and Mr. Martin Woodward for every facility for studying the beautiful preparations of *Heptanchus*, *Cestracion*, &c. in the Biological Laboratory of the Normal School of Science.

² T. H. Huxley, *loc. cit.* p. 40.

³ It is interesting to note that Prof. Cope's Permian Selachian skulls already referred to also exhibit this character.

is much compressed from side to side, the superior edge thus formed being well marked and sharp, but the lower appearing thicker (fig. 2 a). About two thirds of the distance from the upper extremity a gradual twist in the cartilage renders the remaining portion compressed almost from above downwards, and it ends distally in a triangular expansion, well shown on the right. The terminal edge was evidently articulated to a basihyal of considerable size, but of this no trace has been preserved.

At one third of its length from the proximal end, the cerato-hyal exhibits a prominent tuberosity on the lower border (fig. 2, *tu*). This appears to be situated opposite a point corresponding to the attachment of the mandibulo-hyoid ligament of living *Selachians*¹; but I have failed to discover indications of any similar prominence either in *Heptanchus* or the other specimens and figures to which I have been able to refer. It evidently represents a muscular insertion, and one of no small importance. In Teleostean fishes, the well-developed genio-hyoideus arises from an equivalent point in the hyoid arch, and by its insertion at the symphysis acts as the main depressor of the mandible². In the *Selachii*, however, the function is undertaken chiefly by the coraco-mandibulares arising from the pectoral arch, and a differentiated genio-hyoid appears to be wanting. The elaborate researches of Vetter³ in regard to the myology of the jaws and branchial arches in *Heptanchus* and *Acanthias* can leave no doubt that the tuberosity in question is that deep insertion of the great constrictor superficialis muscle which becomes the origin of the genio-hyoid in higher fishes; and its marked character in the Cretaceous *Hybodont* may perhaps indicate that in this form the differentiation had already taken place to a certain extent.

On the whole, the form of hyoid arch just described bears a greater resemblance to that of the Notidanidæ than to that of any other living family. It agrees in the fact that the hyomandibular and cerato-hyal are most contracted at their point of union, but the elements are somewhat stouter than those both of *Heptanchus* and *Hexanchus*.

The type specimen of *Hybodus dubrisiensis* (B.M. 36908) is of somewhat smaller size than the fossil here described, and as its cartilages are apparently less calcified, it probably represents a younger individual. It is comparatively imperfect, and except in the characters of the teeth and the upper border of the pterygo-quadrate, it does not admit of any detailed comparison with the foregoing descriptive account. There are, however, unmistakable indications of an articular otic process, besides a well-marked pterygo-trabecular eminence; and a small fracture shows the slight thickening of the overturned edge of the quadrate region (fig. 6).

¹ W. K. Parker, "On the Structure and Development of the Skull in Sharks and Skates," *Trans. Zool. Soc.* vol. x. p. 210, pl. xxviii. fig. 2.

² R. Owen, 'Anatomy of Vertebrates,' vol. i. p. 206, fig. 135.

³ E. Vetter, "Untersuchungen zur vergleichenden Anatomie der Kiemen- und Kiefermuskulatur der Fische.—I," *Jenaische Zeitschrift*, vol. vii. (1874), pp. 403-458, pls. xiv., xv.

A third fossil in the National Collection (no. 49032) also belongs to the same species, and exhibits the remains of the anterior portion of what was evidently a complete fish at the time of its entombment. It agrees in size with the specimen here described, and exhibits traces of the articular facette on the otic process, in addition to part of the left cerato-hyal with its characteristic lower tuberosity. Fragments of the shoulder-girdle are also preserved, and a portion of the base of the chondrocranium; and the vertebral column is shown for a length of 0.16 m., comprising about 33 well-calcified asterospondylic centra. Unfortunately, all indications of dorsal spines are wanting.

As the typical Hybodonts range throughout the whole of the Mesozoic strata, from the Muschelkalk to the Upper Cretaceous inclusive¹, and as it has been found impossible hitherto to recognize more than one generic type—*Hybodus*—on the evidence of spines and teeth, it would be interesting to compare the modifications in the skull of *H. dubrisiensis* with the corresponding structures in earlier species. As yet, however, no information in regard to these has been published, and the only deposits that have yielded satisfactory specimens are the Lower Lias of Lyme Regis and the Wealden of Pevensey Bay, Sussex. Of such fossils the British Museum contains an unrivalled series, and I hope to attempt the elucidation of the more important of these on a future occasion. It must suffice at present to add that, though there are well-preserved pterygo-quadrates from both the formations mentioned, there appears to be none but the most uncertain evidence of an articular facette on the otic process in any; and if this observation can be confirmed it will become of considerable interest when taken in connection with the fact, pointed out by Prof. Huxley², that the postorbital articulation in the living *Heptanchus* is only acquired comparatively late in the development of the fœtus. It is also interesting to note that one of the Liassic specimens (Brit. Mus. no. P340) exhibits traces of a persistent notochord, with the arches alone calcified, whereas in the Cretaceous form it has just been shown that there are well-differentiated centra. The differences between the anterior and posterior teeth are likewise more marked in *H. dubrisiensis* than in any of the earlier species of which satisfactory remains are known. It would appear, indeed, that there is distinct evidence of specialization as the Hybodonts are traced through the Mesozoic period, and it is almost certain that future research in regard to structures other than teeth will lead to the subdivision of the multitudinous forms hitherto grouped under one generic name.

¹ Teeth indistinguishable from *Hybodus*, and originally described under this name, occur in the Carboniferous, but they have been proved to belong to a distinct genus, *Tristychius* (T. Stock, "On the Structure and Affinities of the genus *Tristychius*, Agass.," Ann. & Mag. Nat. Hist. (5) xii. 1883, pp. 177-190, pl. vii.). There are also other Palæozoic Hybodontidæ, e. g. *Ctenacanthus*,

² *Loc. cit.* p. 44, fig. 9.

EXPLANATION OF PLATE XX.

- Fig. 1. Side view of jaws of *Hybodus dubrisiensis*, Mackie. *pg*, pterygo-quadrate; *mk*, Meckelian cartilage; *p*, pterygo-trabecular process; *ot*, otic process; *hm*, hyomandibular; *ch*, cerato-hyal. (B.M. 41675.)
2. Under view of the same: *tu*, tuberosity on cerato-hyal. *2a*, natural transverse section of right cerato-hyal.
3. Teeth of the same, twice nat. size. *a*, anterior tooth; *b*, hinder tooth.
4. Hyomandibular of the same, back view. *t*, tuberosity.
5. Restoration of mandibular and hyoid arches of *Hybodus dubrisiensis*.
6. Section of the upper border of quadrate region of pterygo-quadrate of type specimen of *Hybodus dubrisiensis*, showing thickening.

Figs. 1, 2, 4-6 are of the natural size.

4. On the Hybrid between *Lagopus albus* and *Tetrao tetrrix*.

By ROBERT COLLETT, C.M.Z.S.

[Received April 1, 1886.]

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Introductory Remarks.

The existence in Northern Europe of two kinds of natural hybrids amongst the Tetraonidæ was already known in the last century, and one form of these is rather common in the forests of Norway and Sweden, as well as in some other parts of Europe, being met with annually in many districts, where its hybrid character is, as a rule, well known to the inhabitants. This is the "Rakkelfugl," the cross between the male of *Tetrao tetrrix* and the female of *Tetrao urogallus*. The male of this hybrid, which has been known since 1744¹, in colour more nearly resembles the cock of *Tetrao tetrrix* than that of *Tetrao urogallus*, whilst the female in this respect is less characteristic and resembles the hens of both species. In shape its hybrid nature is indicated by the form of the tail; in size it is intermediate between both parents, so that both sexes are larger than the father, and the male is even larger than the mother.

The other hybrid, the result of a connection between *Tetrao tetrrix* and *Lagopus albus*, which is called in Norway and Sweden "Rype-Orre," is much rarer, and specimens are still desiderata in most museums. The origin of this hybrid, its habits, and its places of resort are as yet partially, if not wholly, obscure. Its winter plumage is the only one which is generally known, whilst the spring or summer plumage is all but unrecorded.

¹ Kgl. Vet.-Akad. Handl. Stockholm, 1744, p. 181.



J. Smit

Hanhart imp.

HYBRID GROUSE BETWEEN LAGOPUS ALBUS AND TETRAO TETRIX.

J. Smit lith



Hartung imp

HYBRID GROUSE BETWEEN LAGOPUS ALBUS AND TETRAO TETRIX

J. Smith del.

I will therefore endeavour to recount the most important features which have hitherto been noticed concerning this hybrid, which, on account of its rarity, as well as its pretty and peculiar external appearance, is well suited to attract the attention of naturalists.

The earliest account of this hybrid dates from the year 1788, as Sparrman at that time gave an illustration of it and briefly mentioned it as "*Tetrao tetrix, mas, varietas*" in the third issue of the 'Museum Carlsonianum' (pl. 65), without, apparently, having suspected its hybrid character. In 1795 this was first noticed by Sommerfelt ('Topographisk Journal for Norge,' 14 Hefte, p. 50, Christiania, 1795), who described two specimens from the districts about Mjösen in Southern Norway, which he regarded as a hybrid between *Tetrao tetrix* and *Lagopus albus*. From the description, which is comparatively detailed (see below), it is evident that the specimens were males in winter plumage.

Subsequently a male shot in Wermeland in Sweden in 1808 was mentioned and figured by Thunberg (Vet.-Akad. Handl. Stockholm, 1808, p. 195), and he also recognized its hybrid character.

The first who gave a more detailed and elaborated description of it was Nilsson in his 'Ornithologia Suecica' in 1817, and subsequently in his various editions of his 'Skandinavisk Fauna.' Since then it has been occasionally treated of in different works on the fauna of Scandinavia, and here its winter plumage has also been given on plates, as in Nilsson, 'Illuminerade Figurer till Skandinavisk Fauna' (plate 5); Lindblad, 'Svenska Jägareförbundets nya tidskrift,' vol. xi. plate 4 (1873); Sundevall, 'Svenska Foglarna,' plate 34; and Lloyd, 'Game Birds and Wild Fowl of Sweden and Norway' (London, 1867), &c.¹

Distribution.

The "Rype-Orre" has hitherto only been found in Northern and North-eastern Europe, and is known from Norway, Sweden, and Northern Russia.

According to a report which I have just received from Dr. Pleske (of St. Petersburg), these hybrids in Russia are not very unusual. Most of them are obtained in the game market; therefore no special information can be given concerning the localities in which they were procured. He believes that about eight specimens are at present preserved in the Museum at St. Petersburg, most of which are males in winter plumage. Dr. Meves, of Stockholm, informs me that in 1872 he saw two specimens in winter plumage in the Museum at Moscow, both males; whilst others, said to be females, were only partial albinos of the female *Tetrao tetrix*. Dr. Kolthoff, of Upsala, has also seen two male and one female Russian specimens.

It is remarkable enough that as yet there is no proof of their occurrence in Finland; for Mela says, "It has not been recognized

¹ In the 'Zeitschr. für die gesammte Ornithologie,' 2 Jahrg. 1885, p. 47, tab. iii. (Budapest, 1885), Herr Henke has figured and treated of a specimen from Archangel under the name of *Tetrao albo-tetrix hybridus*, fem. This specimen is clearly only a partial albino of *T. tetrix*, fem.

with certainty in our land, but it must surely be found if more carefully sought after" ('Vertebrata Fennica,' p. 164, Helsingfors, 1882).

In Sweden several specimens have been captured, most of them in the northern counties (Helsingland, Jemtland, Norr- and Westerbotten), but a few as far south as Dalarna and Wermeland—as a rule amongst the mountain-ridges of the districts adjoining Norway. Dr. Kolthoff has informed me in a letter, dated Upsala, 7th March 1886, that, according to his knowledge, twelve specimens of this hybrid have been preserved in Sweden, of which the Upsala Museum possesses four (one male, three females). The Museum in Stockholm owns four, of which one is a female. Almost all were found, it may be said, accidentally, amongst the game which is forwarded during the winter from the northern counties to the towns for sale.

Propagation in Norway.

The first specimen preserved in any Norwegian collection was a male in winter plumage, forwarded from Rorös in 1837 to the late Prof. Esmark. Until 1870, hardly more than half a dozen specimens were found or preserved in Norway, all of which were males obtained from the mountain districts in the southern part of the country (the provinces of Christianssand, Bergen, and Hamar); but during the years subsequent to 1870, 15 additional specimens have been obtained.

Thus at least 22 specimens of this hybrid have been preserved in Norway during the last 50 years, among which only two were females. Almost all these have been obtained by the University at Christiania; at present there are eleven specimens mounted (amongst which are the two females), one skeleton, and two skins. A few specimens have been sent abroad, and two are preserved in the museum of Bergen. Of these 22 specimens I have personally examined 13 in the flesh, having myself found some in the game-dealers' shops, while the others have during the last few years been presented to or bought for the museum. All the specimens were found in the southern districts of the country, with the exception of one, which was obtained in Saltdalen near Bodö, thus just within the Arctic Circle (65° N. lat.). The most southern specimen was caught in Sande, near the Christiania fjord (59° 35' N. lat.).

The greater number of the preserved specimens, both in Norway and Sweden, have been in their winter plumage. One reason for this is that the greatest capture of the Tetraonidæ takes place during the winter months, for during the summer they are protected by the game-laws; and another is that the hybrids previous to the assumption of their winter plumage so nearly resemble the young males and the hens of the *Tetrao tetrix* that they are easily passed over unnoticed. In the winter, however, their plumage is so marked and peculiar, that this very seldom happens; but it is very probable that the greater number of individuals do not fall into the hands of naturalists.

In giving the following account of the "Rype-Orre" I have had an opportunity of examining, besides the Norwegian specimens, the four specimens which at present (March 1886) are preserved in the Museum at Upsala, and which, by the kindness of Prof. Tullberg and Dr. Kolthoff, have been forwarded to me for examination. Of these specimens one is a male, namely Thunberg's individual of 1808 (see above), the other three are females.

Besides these I have examined a fine male specimen in winter dress, captured in Wermeland (Sweden) in the middle of January 1886, which I found myself in the game-market at Christiania in February last.

Diagnosis and Configuration.

Tail slightly forked; number of rectrices 18; toes semiclothed, the outermost joints bare; claws long and broad; bill stout; eyebrows covered with warts, and pectinated above.

Colour of male in winter dress: white underneath, with black feathers on the breast and flanks; blackish above, with whitish edges on all the feathers. A white band through the eye, and a blackish beneath it. Tail-feathers black, tipped with white.

The female in winter dress more or less whitish underneath; the back, breast, and flanks (sometimes the entire lower surface) transversely banded with reddish brown and black, all the feathers with whitish edges. Tail black, faintly speckled with brown and whitish.

Bill rather like that of *Tetrao tetrix*, strongly built, but the culmen is not so plainly ridged as in that species; its size in the male is nearly double of that of *Lagopus albus*. The side branch of the mandible strongly developed.

Eye brows covered with numerous small red warts, and with a fine-toothed ridge above. The height of the eyebrows is about half the diameter of the eye; the comb in winter specimens is not very high.

Claws shaped like those of *Lagopus*, long and broad, and very slightly oblique, the inner edge being a trifle broader than the outer. They are less curved than in *T. tetrix*, and their colour is not so dark as in that species.

Toes semiclothed with hair-like feathers, densely in winter; the innermost joint entirely feathered, the middle one naked above, but clothed on the sides, the outermost quite bare. The bare portions covered with horny rings, on the sides with one or two series of rounded scales; under these there is a toothed comb (as in *Tetrao*, unlike *Lagopus*).

Hind toe short, as in *Lagopus* (proportionally much longer in *Tetrao*).

Tail slightly forked, the outermost feathers very slightly bent outwards at the end, and (in the male) 12 to 24 millim. longer than the central ones. Its length is proportionally longer than in *T. tetrix*, and more like that of *Lagopus*.

Under tail-coverts slightly shorter than the central rectrices (or

about one diameter of the eye). In *Lagopus* they are still shorter, or one diameter and a half, in *T. tetrix* one or two diameters longer than the central rectrices.

Male and Female.—Besides the markings and size the following differences occur between the two sexes—the tail of the female is nearly square, the side branches of the upper mandible are more developed, and the comb-like scales of the toes and the ridge of the eyebrows are considerably longer in the male than in the female.

Measurements.

Male.

	Total length.	Wing.	Outer tail-feather.	Centre tail-feather.	
	mm.	mm.	mm.	mm.	
1....	470	242	142	122	Gudbrandsdalen, 7 Dec. 1870.
2....	480	238	147	117	Saltdalen, Nordland, 30 Dec. 1871.
3....	?	237	138	106	Gudbrandsdalen, 8 Oct. 1872.
4....	508	255	142	125	Österdalen, 5 Nov. 1872.
5....	480	252	140	?	Gudbrandsdalen, (?) Nov. 1872.
6....	499	245	?	130	Gudbrandsdalen, 28 Feb. 1873.
7....	505	232	146	124	Hadeland, 27 Dec. 1879.
8....	480	235	135	115	Tolgen, 3 Nov. 1881.
9....	486	235	140	118	Sande Prgd, 9 Nov. 1881.
10....	530	235	150	125	Röros, 10 Oct. 1882.

Female.

11....	423	205	127	97	Gudbrandsdalen, Jan. 1875.
12....	425	205	118	100	Röros, 7 Oct. 1876.

It will be seen from these measurements that the male has an average length of 490 millim., about equal to that of the female *Tetrao tetrix* (but with slightly longer outer tail-feathers). The total length of the female is about 424 millim., being thus considerably less than the male; it is, however, somewhat larger than the male *Lagopus albus*.

Colouring.

Of the fourteen specimens of this hybrid at present preserved in the Museum at Christiania, one is a young bird of the year, on which the brown plumage almost entirely remains; four are young birds changing to winter plumage, the latter being predominant; finally, are eight in full winter plumage, and amongst these are two females. Besides these there is one specimen (a male in winter plumage) exhibited as a skeleton.

In winter plumage are also the specimens in the Bergen and Upsala Museums. The specimens at Stockholm are likewise, so far as is known, in winter plumage, or in the changing from autumn to winter. A long link in the series is entirely wanting in all these collections, namely—the spring plumage, which is probably unknown; the summer plumage, which is in all cases known from

the description of a single specimen in an old treatise (see below); and finally the young in down, which is also unknown¹.

Winter Plumage.

The winter plumage develops itself in Norway during October, and as a rule is completed by the latter half of the month. Whilst one or two of the males had not moulted the last autumnal feathers in the beginning of November, one of the females was in full winter plumage on the 7th of October. This, however, was not an accidental circumstance, but has its analogy in *Lagopus albus*, in which the change to winter plumage takes place more rapidly in the females, although they begin to change later than the males.

The tarsus and toes are then fully clothed, and the naked outer half of the toes is completely hidden by the overlying hair-like feathers.

The male in winter (Plate XXI. fig. 1) has the upper parts black with greyish-white, finely freckled edges to the feathers; the under surface is white, with an irregular black patch on the breast which may be of greater or less extent, occasionally parted in the middle, or so small that there only remain a few black feathers. On the flanks a few black feathers are always present, but sometimes hidden by the white ones. The wing-coverts are chiefly white, speckled with brown. The wing-feathers are brownish black, finely speckled with grey; the outer web of the primaries is white. A more or less conspicuous white band passes through the eye, and under this a similar black one (including in most cases, but not always, the chin), with narrow white edges to the feathers. The upper tail-coverts are black with broad white edges; under tail-coverts white. The tail-feathers are black with narrow white tips, which almost disappear on the outermost ones. The front of the tarsus is greyish.

The eyebrows are bright red; their height 11 millim., of which the upper toothed ridge is $4\frac{1}{2}$ millim.

Although the winter garb is remarkably similar in its general appearance in the different individuals, a slight variation in some details will always be found. In some the unspotted white parts are more extended than in others, while in others the black feathers are predominant on the flanks and abdomen. One of the specimens in the University Museum (Nov. 1881) was unusually dark, with a very large patch on its breast, nearly black scapulars, and numerous black feathers on the abdomen.

The female in winter (Plate XXI. fig. 2) has the upper parts banded with black and yellowish brown, and whitish freckled edges to the feathers. The ground-colouring of the lower parts is white, each feather blackish at base; the breast and flanks barred with yellowish brown and black, and edged with white. The wing-coverts are speckled with white, greyish brown, and rusty yellow; the wing-

¹ A more detailed account of the different plumages I have given in 'Videnskabs-Selskabets Forhandling, Christiania,' 1872 (p. 238); and 'Nyt Magazin for Naturvidenskaberne,' vol. xxiii. 1877, p. 159, and vol. xxvi. 1881, p. 324.

feathers are brownish black, finely speckled with grey. A whitish stripe passes through the eye, under this a brown one. The upper tail-coverts irregularly barred with black, greyish brown, and yellowish brown, with broad white edges. The under tail-coverts white, sometimes a few feathers banded with rusty. The tail-feathers are black, with the outer web speckled brownish grey or whitish, and white-tipped; the centre pair entirely mottled. The front of the tarsus as in the male.

Thus in winter plumage there exists this difference between the sexes, that those parts which in the male are black with white edgings to the feathers, are more or less mottled brown in the female, and instead of the male's black spot on the breast the female has the breast barred with yellowish brown. Of the three females from Sweden which at present are preserved in the Upsala Museum, two (Jemtland, Feb. 1886; Angermanland, Jan. 1861) are normal, and on the whole similar to the before-mentioned Norwegian specimens. The last is, however, rather light-coloured: thus the barred feathers on the flanks are quite covered with white ones, so that these portions seem to be unspotted; the throat likewise is snowy white. Both are young individuals; this is seen by their slender and unworn beaks.

The third female (Jemtland, January 1885) was somewhat different, and very dark in colour, without any part of its abdomen being entirely white. This was an old bird, the beak coarse and well-worn on the edges and point. The ovary was (according to Dr. Kolthoff) plainly visible. On the rump several well-worn autumnal feathers with brown cross lines remained amongst the white winter feathers. Its essential peculiarities were as follows:— On the upper parts, wings, and tail normal, though intermingled with a somewhat stronger reddish-brown colour. The whole of the lower half from the beak to the rump evenly furnished with broad brown and black cross bands; a few feathers quite white, others had white edges. In other respects like the former ones. Size normal.

Although this specimen was decidedly more darkly coloured underneath than the others, its general characteristics in markings and shape were otherwise quite in conformity with them.

Summer Plumage.

The period in the spring at which the individuals begin to change their winter plumage is unknown. All the specimens which I have examined were captured in the months October to February; and on a specimen in the Museum at Bergen, shot in Voss (Bergen Stift) about the 1st March 1868, there is yet no trace of spring plumage visible.

Whilst the spring plumage of the Rype-Orre is as yet unknown, there exists one account of a specimen in its summer garb. In 1823 Mr. Sommerfelt, jun.¹, in 'Magazin for Naturvidenskaberne,'

¹ A son of the Mr. Sommerfelt who is mentioned above (p. 225) as having for the first time brought to notice its hybrid character.

1 Aarg. 2 B. p. 71 (Christiania, 1823), described a specimen in summer plumage which he obtained from Thoten (near the lake Mjøsen in Norway). From the size of this specimen it appears to have been a male. The statement is as follows:—

(Male? in summer (July)). “*Caput, collum, dorsum, pectus Tetraonis tetricis fœminæ. Remiges primores et secundariæ albæ, plurimum tetricum albæ. Rhachis remigis 1^m fusca. Rectrices nigræ apicibus albis, duabus mediis nigris ferrugineo-undulatis exceptis. Cauda non forficata. Abdomen et femora ut in T. tetricæ fœmina, modo pennis singulis albis ornata. Digiti sublanati. Magnitudo T. tetricis fœminæ.*”

The colouring of the summer plumage thus generally resembles that of the Greyhen, but is distinguished by a few white feathers on the abdomen. The tail-feathers also differ from the winter garb in that the central pair are transversely banded with brown. An inaccuracy has probably been made in describing the wings as white instead of “whitish,” as in summer it is not likely that the white colour would be more extended than in winter; (and the description “*digiti sublanati*” contradicts the possibility of the specimen being a partial albino of the female *Tetrao tetricæ*).

Young Plumage.

The plumage of the young is, as one might expect, mottled brown like both parents, but the upper parts remind one more of *Lagopus albus*, the lower parts of *Tetrao tetricæ*. I found a single specimen, a male, in this garb amongst a parcel of game from Österdalen (South-eastern Norway) in the autumn of 1880; it had been probably shot or captured at the end of September. The plumage of the young on the whole is still retained, but a few winter feathers have already appeared amongst the brown; the wings and the outer tail-feathers are also new, and belong to the winter plumage, and thus present a striking contrast to the other mottled brown feathers.

Young male in autumn (Plate XXII. fig. 1).—The upper parts mottled and banded by rusty yellow and black, almost the same as in the young of *Lagopus albus*, the cross bands being narrower and closer than in the young of *Tetrao tetricæ*. In the longer wing-coverts there is a discernible light elongated patch along the quills. The tail-feathers, as in *Lagopus albus*, jun., are transversely banded with black and reddish brown.

On its lower parts the breast and sides, as in the young of the *Tetrao tetricæ*, are closely and evenly banded with black and rusty yellow, and both colours are about the same extent. In this respect they more nearly approach the last species than *Lagopus albus*, as the young birds of Willow-Grouse have the rusty brown colour much more developed (so that the breast can be said to be a rusty yellow with irregular black patches or broken cross bands). The under tail-coverts are barred by greyish white and brown as in *Tetrao tetricæ*. The throat is barred, but not so manifestly as the breast.

The covering of the feet is still thin and incomplete, and the hair-like feathers have only appeared on the innermost toe-joint; the claws are brown horn-colour, resembling those of the Blackgame, but their form is more like those of the Willow-Grouse.

The change of the young to winter plumage (Pl. XXII. fig. 2) proceeds in about the same manner as in the Willow-Grouse; and, analogously with what takes place in them, the first plumage has not always time for development all over before it is dislodged by the winter garb. As already mentioned, the remiges with their longer coverts, the abdomen, and after them the tail-feathers, are the first parts which moult into the winter garb. In the beginning of October the young plumage of the male is half lost, and the winter plumage completed on the tail and belly, and partially on the back, whilst the head, neck, and upper breast are still mottled brown; one or two brown autumnal feathers are also long retained on the flanks. The covering of the toes is still scanty. The Christiania Museum possesses several such specimens.

Sex.

As previously mentioned, amongst the twenty-two known specimens from Norway there are but two females. This may partly be for the reason that the hens even in winter plumage have on the whole a less attractive plumage than the males, and therefore might be more easily overlooked, or pass for a white-speckled Greyhen. But the main cause may probably be a different one. It is a well-known fact, confirmed by a majority of instances, that amongst hybrids an unusually large percentage of males are produced. If compared with the other and better known hybrid of the Tetraonidæ, the "Rakkelfugl" (*Tetrao tetrix* male + *Tetrao urogallus* female), it will appear that there are perhaps ten males to one female.

However, it must be remembered that the female Rakkelfugl is even to a greater extent more likely to be overlooked than the hen of the Rype-Orre, as it exactly resembles a small female *Tetrao urogallus*, so that this proportion cannot be computed with accuracy.

In all the males dissected (in winter) the *testes* have been found to be small, although not rudimentary or abnormally formed. Their colour was greyish white; the left was generally larger than the right, and measured in one specimen 5 millim. in length, the breadth about 3 millim. In another, and this towards the spring (28th February), they were unusually small, barely 2 millim. long. In the hens, which were also shot in winter, the ovary was visible on the left side like a small whitish patch; the eggs were hardly discernible.

Supposed Parentage.

Which species contributes the father and which the mother to this peculiar hybrid is as yet unknown. Only exceptionally has it fallen to the lot of an intelligent sportsman to see it in its living state, and then only for the few seconds in which it rises, to fall

again to his gun. The knowledge of its life and habits therefore amounts to almost nothing, and no observations have been made in Norway which can give any information concerning its origin.

The existence of this hybrid arises from the fact that both parents not unfrequently inhabit the same localities. Thus *Tetrao tetrix* in the southern valleys of the land, where most of these hybrids are met with, regularly ascends to the elevated birch-forests on the mountains, and establishes itself in the regions where *Lagopus albus* has its proper home. On the other hand, but more rarely, *Lagopus albus* descends and breeds in the upper portions of the conifer-woods, where the other species is still to be met with in numbers.

In the northern portions of the country, however, where both species live almost at the same elevation above the sea, and still more commonly share the same place of residence, the *Tetrao tetrix* on the whole appears in much lesser numbers than the other species, and the hybrids are here apparently more rare.

It is not easy to understand the true reason for the pairing between two species so different in their habits, appearance, and nature. One of the specimens obtained in Norway was shot at a place (Saltaldalen in Nordland) where no want of mates of either species could be observed in the neighbourhood. Connections of this kind are repugnant to nature, and in many cases the only feasible explanation is to be found in imagining a violent and irresistible desire to breed out of the species.

Concerning the question of the origin, it is first of all necessary to find out whether one or two sorts of such hybrids exist—the one bred between the male *Lagopus albus* and female *Tetrao tetrix*, the other between the male *Tetrao tetrix* and female *Lagopus albus*¹. But as it is an established fact that all individuals hitherto found (with us) of the Rype-Orre, if obtained at the same season of the year, are on the whole singularly alike both in size and the colouring of their plumage, their origin cannot be ascribed to more than one of the two possible connections.

When Prof. Nilsson in 1817, in his 'Ornithologia Suecica,' treated of its descent for the first time, he mentions it (p. 303) as "*Hybridus a Tetrice patre et Tetr. subalpino femina*"². This assumption that it is the male of *Tetrao tetrix* which has formed an illegitimate connection with the female of *Lagopus albus* (as it is also the Blackcock that with the female of *Tetrao urogallus* produces the "Rakkelfugl"), has always been and is still generally accepted by most naturalists. Upon this theory it has received the names:—*Tetrao lagopoides*, Nilss. Skand. Fauna, 1st ed. (1828), and *Tetrao lagopides*, 2nd ed. (1835); *Tetrao lagopoditricides*, Sundev. Svenska Fogl. p. 255 (186-?), (being the descendant of *Tetrao tetrix*, *mas*, it had to bear its generic name); and, finally,

¹ A hybrid between *Lagopus mutus* and *Tetrao tetrix* is rather improbable, on account of the very different haunts of these species.

² "*Qui vero videt (illas) varietates, non diutius dubitare potest de libidine Tetricis ad furtivos amores cum congeneribus instituendos semper paratissima.*" (Nilss. l. c.)

Lagopotetrix lagopoides, Mahn, Öfv. Kgl. Vet.-Akad. Förh. 1880, p. 30.

In opposition to this assumption respecting its paternity, in 1872, in a treatise "Remarks on the Ornithology of Northern Norway" (Forhandl. Vidensk. Selskabet i Christiania, 1872, p. 238), I advanced the opinion that the Rype-Orre was an offspring of the male *Lagopus albus* and female *Tetrao tetrix*, a theory which, singularly enough (although without any proof), was started by Sommerfelt so early as 1823 in his descriptions of the specimen in summer plumage¹ (cf. above). In support of this theory I certainly could not produce direct observations or positive proofs, but I stated some circumstances which, according to my views, caused the descent from the male *Lagopus albus* to be more probable than from that of the Blackcock. In conclusion, I expressed the hope that intelligent sportsmen or naturalists might soon be fortunate enough to institute observations by which this question might be clearly solved. Although this was written fourteen years ago, nothing has as yet appeared in northern literature to throw a light on the subject.

I shall not here set forth at length the reasons which caused me to advance this hypothesis; they will be found given in Dresser's 'History of the Birds of Europe,' vol. vii. p. 213. They are chiefly derived from a comparison with the second and better-known hybrid, the "Rakkelfugl," concerning which it is an undoubted fact that it is descended from the male *Tetrao tetrix* and the female *Tetrao urogallus*. In this case, too, the father belongs to the smaller, the mother to the larger species; and the offspring is a hybrid in which the male is of about the same size as its mother.

It is also a well-known fact that the male Willow Grouse is often found in the breeding-haunts of the *Tetrao tetrix*, and undoubtedly frequents them more often than is generally known. Every sportsman is aware that amongst the Willow-Grouse (and the Ptarmigan) an excess of males is to be met with, which throughout the summer ramble about on the mountains, and these are probably willing to form connections whenever an opportunity offers. My friend Prof. Friis has witnessed a remarkable proof of the eagerness of the male Willow-Grouse's desire to mate. In the spring of 1857 he observed at one of the most elevated farms in Nordmøre (Bergen stift) a male Willow-Grouse which for several succeeding days kept near the house and endeavoured to form a connection with a white speckled domestic hen.

Finally it is worth recording that two young male Rype-Orre, shot in October 1845, in Hedemora, Sweden, were accompanied by a female bird, apparently their mother, which was supposed to be a Greyhen². This observation would have been of great weight in

¹ "Af denne Slægts (*Tetrao*) hybride Yngel forekom mig paa Toten i Juli Maanedes Begyndelse følgende, som sygnes at være en Afledning af Aarhönen og Rype-Hannen" [From the hybrid brood of this genus I obtained the following in the beginning of July, which appears to be an offspring of the Greyhen and the male Willow-Grouse] (Nyt Mag. f. Naturv. 1st ser. vol. ii. Christiania, 1823, p. 71).

² Öfv. Kgl. Vet.-Akad. Förh. 1847, p. 201.

supporting the theory, if it had only been *clearly proved*, as probably the young hybrids continue to follow their mother for long.

I again remark that for the theory of parentage here advanced there is indeed no positive proof, and that it is an hypothesis which may be wrong, but that it appears to me to have at least as much reason in it as the older one (which is also without proof) of the descent from the male Blackcock. On the whole it is remarkable enough that up to the present not one direct observation has been made (such as an observation of the two species *in copula* in their wild state, or of the two species pairing in captivity). That such observations will not be wanting hereafter, is a matter of course.

I have just received a fresh contribution to this question in a letter from Dr. Pleske, dated St. Petersburg, 16th March, 1886, in which he directs my attention to a communication from Mr. A. Rasin in 'Journal für Jagd und Pferdezzucht' ('Journal Ochoty i Konnosawodstwa'), 1869, pp. 340-341, with the title "Eine Sündenfall des Schneehühnes." From this it would appear to be proved that the *Tetrao tetrix* is the father, *Lagopus albus* the mother. This report, the original of which I cannot peruse, is referred to in the following terms by Dr. Pleske:—

"Im Kreise Nowgorod, auf dem sogenannten Konewschen Moosmoraste, wurde eine Kette Hühner gefunden, die von einem ♀ des *Lagopus albus*, welches erlegt wurde, geführt wurde. Von den zwei erbeuteten Jungen hatte beide einen vollständigen Habitus junger Birklühner, waren auch grösser als die Mutter, und unterschieden sich von echten Birklühnern nur dadurch, dass beim einen 4 Steuerfedern und zwei Schwungfedern des rechten Flügels weiss waren, beim anderen der linke Flügel vollständig wie bei *Lagopus albus* gezeichnet war, nicht allein in Betreff der weissen Schwungfedern, sondern auch der rostrothen Deckfedern." If the original communication gives no further information upon the subject than the words cited above, no proof is given, in my opinion, that these two specimens were really hybrids.

In the first place there is no description of the covering of the toes, which is the only feature in its diagnosis that is reliable at every age and in every plumage; and, secondly, the true Rype-Orre has never, so far as I am aware, been known to have white feathers in the wing (even the young *Lagopus albus*, before they assume their autumn dress, have brown wing-feathers), and it is still less likely to have them on the tail. The fact that the two young specimens were not even similarly coloured, speaks also for the probability of their being only partial albinos of *T. tetrix*, which in so many instances have been and still are taken for the Rype-Orre.

It may be open to question whether, upon the whole, it is necessary to designate a hybrid by a scientific appellation, even if, like those of the Tetraonidæ, it arises spontaneously, and, as it were, normally. The "Rakkelfugl" has, as is known, received from Nilsson the name *Tetrao urogalloides* (1828) or *urogallides* (1835), which was altered by Sundevall to *Tetrao urogallo-tetricides* (186-?), and by me to *Tetrao urogallo-tetrix* (1872). In accordance with this, as I have

pointed out in my previously mentioned article of 1872, the "Rype-Orre" should receive the name of *Lagopus tetrici-albus*, assuming that the descent is as above supposed.

Other Hybrids of the Genus Lagopus.

1. *Lagopus scoticus* and *Tetrao tetricus*.—In the spring of 1877 I had the opportunity of examining a specimen in Mr. Dresser's collection in London which was considered to be a hybrid between *Tetrao tetricus* and *Lagopus scoticus*. This specimen was a male, shot in Scotland on the 12th of September, 1876. Its hybrid nature was discernible at first glance from the formation of the tail and the covering of the toes, which were exactly like the northern 'Rype-Orre.' The colour was brownish black, the back was finely mottled with brown on an almost black ground; the breast was black, the head and throat black with fine brown spots; the abdomen had reddish-brown cross lines, the lower tail-coverts white edges, as also had several of the feathers on the sides of the rump.

In conformity with the name which above is given to the North-European Rype-Orre, the Scotch specimen, provided the mother in both instances is *Tetrao tetricus*, has been named *Lagopus tetrici-scoticus* (Nyt Magazin for Naturv., Christiania, 1877, vol. xxiii. p. 163). Another specimen of the same hybrid, also a male, was described by Malm, from Gothenburg, in Sweden. This was found in December 1877, at a spot where *Lagopus scoticus* had been introduced in 1861 and 1862 (CEfv. Kgl. Vetensk.-Akad. Förh. 1880, p. 17). This bird was called by Malm *Lagopotetrax dicksonii*.

2. *Lagopus albus* and *Lagopus mutus*.—As in the previous notes it has been supposed possible that the male *Lagopus albus* may be as desirous of forming an illegitimate connection as the male *Tetrao tetricus*, I shall touch upon another question affecting the same subject. It has probably appeared to be strange that, notwithstanding that *Lagopus albus* and *Lagopus mutus* often appear in considerable numbers in the same districts in Northern Europe, and generally share each other's haunts, no evidence of a cross between them, so far as is known, has ever appeared. It is not probable that the cause of this should have its origin in a true repugnance in the two closely-allied species to form hybrids. Probably these hybrids are less rare than one imagines, as it requires an accustomed eye to discern them in the multitudinous garbs in which these two species appear from spring-time until the approach of winter. Even I myself have but once found one, which is now mounted in the University Museum at Christiania. It was shot at Rörös in the middle of September 1883.

This specimen is an old male in autumnal plumage, and is thus at a stage when the contrast between the plumage of the two parents is most marked and striking. At this time the old *Lagopus mutus* obtains its peculiar bluish-grey autumnal dress, in which each feather on a light ashy-grey ground is finely freckled with black, without forming distinct cross lines, whilst in *Lagopus albus* each feather has reddish-brown spots and cross lines on a black

ground. In the hybrid specimen the colour and markings of the feathers are a complete mixture of the two species. The upper plumage most resembles *Lagopus mutus*, as the feathers there and on the flanks are finely speckled with black, but on a somewhat reddish ground, though this is not of so strong a colour as in *Lagopus albus*. The pattern on the feathers is almost similar to *Lagopus mutus*, and the long feathers on the flanks and the upper tail-coverts, which are wanting in distinct cross lines, especially differ from the corresponding parts of *Lagopus albus*. One or two feathers, however, resemble the last species. The cross bands on the head are also much the same as in *Lagopus mutus*, and thus more dense than in *L. albus*, but rather indistinct and irregular. The lores are speckled with traces of the black colour which is peculiar to *Lagopus mutus*.

The under-plumage is borrowed most from *Lagopus albus*, especially in colour. The feathers are transversely barred as in *Lagopus mutus*, but the colour is red, almost similar to that of *Lagopus albus*. The fine cross lines are particularly sharply defined and numerous from the bill to the vent, an unknown feature in *Lagopus albus*.

This hybrid has, on the whole, adopted the pattern of its feathers from *Lagopus mutus*, and the colouring (especially underneath) from *Lagopus albus*. The bill in size was intermediate.

It is naturally impossible to state which of the two species supplies the father and which the mother.

3. *Bonasa bonasia* and *Lagopus albus*.—Amongst the specimens belonging to the Upsala Museum sent to me for examination there was a fifth specimen which appeared to be an example of quite a new combination. It was stated by Dr. Koltzoff to have been captured in Jemtland (Sweden) in November or December 1884. The covering of the toes is just the same as that of the normal Rype-Orre. The colour is lighter than any of them, the whole upper parts, and especially the tail-coverts, having broad white (not whitish) edges. The inner hidden parts of the back-feathers are particularly dark and somewhat mixed with brown. The tail-feathers, especially at the root, are much mottled with whitish grey, and the outer feathers edged with white on their inner halves. The underside is white, with the throat black, and with dark-coloured but not cross-lined feathers on the flanks hidden under the white. The head is unusually white, with small dark edgings on the feathers of the forehead, and greyish ear-coverts. The inner half of the under tail-coverts is blackish.

Although the specimen was a male bird with well-defined *testes*, its size was even less than a female Rype-Orre (wing 181 millim.), and was about the same size as *Lagopus albus*. It is therefore impossible that this specimen could have been the produce of a cross between Willow-Grouse and Blackcock. Neither is its tail forked, but somewhat rounded (the outer tail-feathers 115 millim., the centre ones 118 millim.) and contains but 16 feathers.

It is therefore more reasonable to suppose this individual to be a cross between *Bonasa bonasia* and *Lagopus albus*, even if one must

recognize the fact that these two species but seldom meet ; but such is by no means an impossibility.

4. *Lagopus scoticus* and *Lagopus mutus*.—A supposed hybrid between the Red Grouse and the Ptarmigan was exhibited at the meeting of this Society, November 5, 1878, by Prof. Newton. The bird was shot in September, 1878, in Sutherland. "As will be seen, it bears some considerable resemblance, above, to a hen Ptarmigan in summer plumage ; but its general appearance is much darker. Beneath, there is a greater resemblance to the young of the Red Grouse ; and the primaries are much as in that bird, being, however, partially edged with white to a much greater extent than is commonly found in the latter." (Proc. Zool. Soc. 1878, p. 793.)

Habits.

Concerning the habits of the Rype-Orre very little is known. Almost all the specimens which hitherto have been discovered have been brought to the towns with other game snared or shot in the autumn or winter by peasants, without attracting any notice. The peasants themselves, as a rule, regard them as a peculiar kind of Willow-Grouse. In the following instances only have I heard of its being shot by true sportsmen who well knew what it was they had brought down.

On the 30th of November, 1871, a male bird was shot by my friend Herr Berbom, Inspector of Forests, in Saltdalen (within the Arctic Circle), the most northern spot in which this hybrid is known. The locality was a low hill covered with birch-woods, some tarns and marshes ; it was occupied by both Blackgame and Willow-Grouse. Mr. Berbom has just informed me, in reply to my inquiries, that this specimen appeared to be solitary, keeping company with neither one nor the other species.

The other case does not either throw any particular light on its habits. On the 7th of October, 1876, another friend, Engineer Oxaal, while shooting "Li-Rype" (Willow-Grouse) at Rörös, shot one (a female) in the usual haunts of the "Rype," about 2700 to 3000 feet above the sea. It was on the ground, and ran forward from behind a tuft of grass after the dog had pointed. It was therefore shot whilst running, and in this respect it appeared to Mr. Oxaal to differ from a Willow-Grouse, which at such a time would in all probability not have exposed itself. It was alone, and no Willow-Grouse or Blackgame were met with in the neighbourhood. Notwithstanding that the season was but little advanced, this bird had completely adopted its winter dress, and scarcely a feather remained of its summer plumage.

An older account from Sweden gives a little more information concerning its habits. In October 1846 two young birds were shot in Dalarne which were accompanied by a hen, supposed to be their mother, and which appeared to be a female *Tetrao tetrix*. On this occasion one of the two young birds perched in the trees (unlike a Willow-Grouse, but like a Blackcock). They had a harsh cackling

cry, "which resembled that of the Capercaillie." (Levin, *Œfv. Kgl. Vet.-Akad. Förl.* Stockholm, 1847, p. 201.)

Most of the specimens which have come into my hands in a fresh state had no gun-shot wounds, and probably had been snared; but whether these were taken in snares together with Rype in districts frequented by the latter, namely in the *regio alpina* (the upper limits of the birch-region on the mountains), or with *Tetrao urogallus* and *T. tetrix* in the forest-regions, cannot be stated with any certainty. If remains of their food are examined it will probably be found that they more usually share the quarters of the Willow-Grouse than those of the other species.

One of the specimens sent to the University Museum (from Sande Sogn, Nov. 9, 1881) was shot not far from the Christiania Fjord, in a district where the *Lagopus albus* certainly breeds, but in very few numbers, and this is hardly an annual occurrence, the locality being comparatively low. The sender of this bird, who regularly received game from that place, deemed it certain that it had been captured along with Blackgame, as it was forwarded to him in a bunch of these birds, and he never received Willow-Grouse from there.

Food.

In some of the individuals opened by me the food was still partially or wholly entire, and consisted of the following:—

1. Male, Dec. 7, 1870: a number of fragments of a *Salix* (15 millim. in length), fragments and numerous berries of *Myrtillus nigra*, tops of *Calluna vulgaris* (about 30 millim. in length), and a few leaves of *Arctostaphylos alpina*.

2. Male, Dec. 6, 1872: tops and seeds of *Carex stellulata*, a few berries of *Oxycoccus palustris* and *Juniperus communis*, some of the latter in an unripe state.

3. Male, Feb. 28, 1873: leaves of *Vaccinium vitis idæa*, fragments and buds of a *Salix* and of *Myrtillus nigra*.

4. Female, Jan. 1875: a number of ripe and unripe berries of *Juniperus*, also a number of the peculiar bunchy leaves of that bush, in which *Cecidomyia juniperina* had formed their capsules; a large number of stalks of the *Myrtillus nigra* (about 12 millim. in length), some leaves of *Vaccinium vitis idæa*, some old female and many young male catkins of *Betula glutinosa* (the mountain form, *alpigena*), and, lastly, the twigs of a haired *Salix* (*S. glauca*?).

5. Female, Oct. 7, 1876: some berries of *Empetrum nigrum*, also stalks of *Myrtillus nigra*.

6. Male, Dec. 27, 1879: leaves and berries of *Oxycoccus palustris*.

7. Young male, autumn, 1880: berries of *Oxycoccus palustris*, also the top of a *Carex*.

From these examples it will be seen that this hybrid both in winter and summer derives nourishment from about the same sources as the Willow-Grouse, namely stalks of willows and bilberries,

also leaves and twigs of different plants, procured principally on the marshes, and occasionally (like *Arctostaphylos alpina*) from the true alpine district; likewise from various berries, and occasionally from birch-catkins. Several of these articles of nourishment form the food of Blackgame; nevertheless it is certain that most of them come from marshy places, from which it must be assumed that its diet most resembles that of the Willow-Grouse.

Skeleton.

In a skeleton of a male from Saltdalen (Nordland) the measurements are as follows:—

	Millim.
Length of the skull (bill included)	63
Greatest breadth of the skull	23
Length of scapula	78
Length of humerus	73
Length of radius	65
Length of ulna	71
Length of os coracoideum	55
Length of metacarpus II.	39
Length of the two phalanges of digitus II.	31
Length of furcula (to the edge of the plate)	66
Length of sternum	120
Greatest height of crista sterni	34
Length of pelvis (to the first caudal vertebra)	73
Greatest breadth of pelvis (across ossa ischii)	57
Length of femur	76
Length of tibia	21
Length of tarsus	45
Length of middle toe (claw not included)	45

As the skeletons of the two parents, *Lagopus albus* and *Tetrao tetrax*, resemble each other so nearly that, apart from their difference of size, it would be difficult to find out the most trifling characteristic, this hybrid hardly has one distinctive feature in the structure of its skeleton beyond its difference in size.

Christiania, March 1886.

EXPLANATION OF THE PLATES.

PLATE XXI.

Hybrid between *Lagopus albus* and *Tetrao tetrax*.

Fig. 1. Male in winter dress.

Fig. 2. Female in winter dress.

PLATE XXII.

Hybrid between *Lagopus albus* and *Tetrao tetrax*.

Fig. 1. Young male in early autumn dress.

Fig. 2. Young male in late autumn dress.



CTENOSAURA ERYTHROMEIAS

5. Description of a new Iguanoid Lizard living in the Society's Gardens. By G. A. BOULENGER., F.Z.S.

[Received April 6, 1886.]

(Plate XXIII.)

Amongst the recent additions to the Society's living collection of Reptiles is an example of Lizard of the genus *Ctenosaura*, which the Secretary has requested me to determine. It belongs to an undescribed species, which I propose to call

CTENOSAURA ERYTHROMELAS, sp. n. (Plate XXIII.)

Body a little depressed. A slight indication of a dorso-nuchal crest. Scales on posterior part of back a little larger than ventrals, rhomboidal, indistinctly keeled. Upper surface of hind limbs with large spinose scales. Tail shorter than head and body, much depressed, except quite at the end; its upper surface with transverse series of very large, subequal spines, directed upwards and backwards, alternating with series of very small scales; the series of small scales inconspicuous, at first glance, on the anterior half of the tail; lower surface of tail with smaller pointed keeled scales, the number of transverse series being the same as on the upper surface. Eight femoral pores on each side. Blackish olive above, with a large patch of vermilion-red on each side of the body, and variegations of the same colour on the sides of the head and neck; lower surfaces grey, throat marbled with red; three oblique black bands on each side behind the fore limb; two black bands across the humerus. Tympanum yellowish. Iris golden.

Length from snout to vent 100 millim., head 24, tail 88.

The locality of the single specimen, acquired by purchase of Mr. W. Cross of Liverpool on the 3rd inst., is not known.

This new species again lessens the gap between the genera *Ctenosaura* and *Cachryx*. I therefore propose to unite the two genera. In connection with this subject I must draw attention to an extraordinary statement to be found in one of Prof. Cope's latest papers¹. He remarks:—"This genus (*Cachryx*, Cope) is of the type of *Ctenosaura*, differing only in the characters of its tail. It lacks the terminal portion, which is in that and other genera free from spinous scales. *It is not in my opinion allied to Urocentron or Hoplocereus, as suggested by Bocourt, genera which belong to the terrestrial division of the family, or Humivagæ.*" Mr. Cope not only omits to add that I was the first to assign his genus to the correct place in the system, but forgets that he is himself responsible for the error now corrected, and not M. Bocourt, who simply endorsed his views; for on referring to Cope's original (and unique) account of *Cachryx*² we read, "*This genus is allied to Urocentrum and Hoplurus, but differs in the possession of femoral pores.*"

¹ Proc. Amer. Philos. Soc. 1885 (1886), p. 270.

² Proc. Acad. Philad. 1866, p. 124.

6. Remarks on Specimens of *Rana arvalis* exhibited in the Society's Menagerie. By G. A. BOULENGER, F.Z.S.

[Received April 14, 1886.]

(Plate XXIV.)

An interesting addition has recently been made to the series of Batrachians in the Society's menagerie—the Oxyrrhine Frog, *Rana arvalis*, Nilsson, so often described and its specific validity discussed. It is, with the exception of *Rana iberica*, Blgr., the only European Batrachian as yet never figured. The accompanying illustration (Plate XXIV.) is intended to supply this desideratum. My friend Professor Born, of Breslau, favoured me this spring with about 50 breeding specimens of the Frog in question, some of which have been presented to the Society. Two years ago, I also received a number of these Frogs from the same gentleman, which have afforded me an opportunity of verifying the additional observations on the characters of the species recently made by Pflüger and Smith¹. These authors have shown that some of the characters hitherto regarded as diagnostic comparatively to *R. temporaria* are not constant. Thus the shape of the snout, often given as the principal distinctive character of the two species, is not absolutely constant; and specimens of *R. arvalis* may be found with the snout less pointed than certain specimens of *R. temporaria*. Also breeding males of the former species possess black rugosities on the thumb in every respect similar to those of *R. temporaria*. This statement I have been able to verify not only on the Breslau specimens, but on a Swedish one, for which I am indebted to Dr. Westerlund. However, the breeding specimens from Copenhagen, in M. Lataste's collection, which I described in my monograph of the *Ranæ temporariæ*, have grey, not black, asperities. It is therefore a question whether the colour of the copulatory asperities does not vary according to localities. Besides, the web between the toes is longer in the Copenhagen specimens. The character derived from the vomerine dentition has also been shown by these authors to be an unreliable one. I may add that the remark is not only true in this case, but applies to European species of *Rana* generally; among the hundreds of specimens of *Rana esculenta* which have been examined by me, not a few have the vomerine teeth inserted *behind* the line of the choanæ, and would as regards this character fall in the section *R. temporariæ*! Differences in the dentition exist which may often assist in the discrimination of species, but are not sufficiently constant to be regarded as good characters. The criterion for the easy distinction of *R. arvalis* from *R. temporaria* is the metatarsal tubercle; this character is an infallible one, and will remove any hesitation in the determination. Of greater importance still, but less easily ascertainable, is the character of the spermatozoa. Should any one still entertain doubts as to the specific validity of

¹ Arch. f. ges. Physiol. xxxii. 1883, p. 525.



P. W. Gough, del. and sculp.

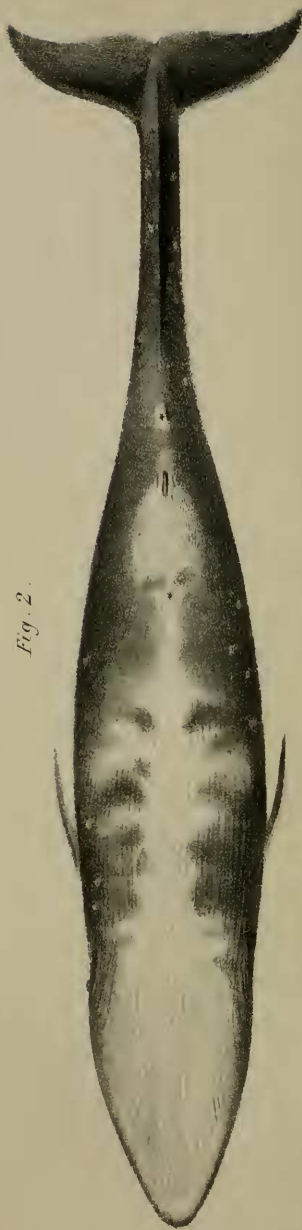
RANA ARVALIS.

Minturn Basin, Miss.

Fig. 1



Fig. 2



J. Smit lith

Hanhart imp

BALÆNOPTERA BOREALIS



Fig. 2

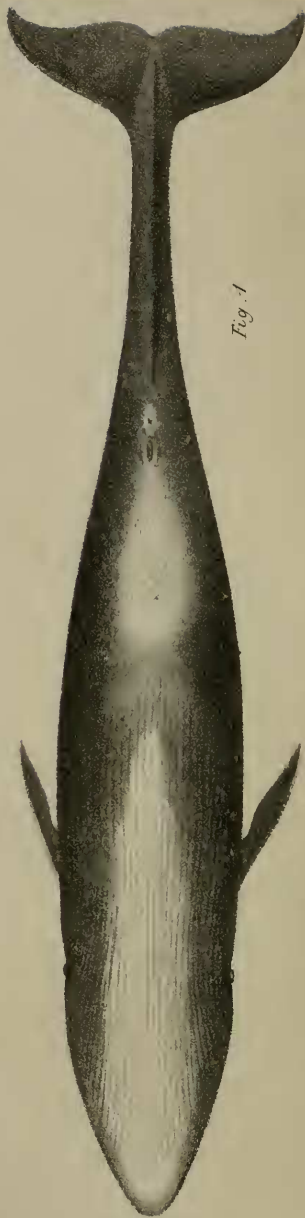


Fig. 1

BALÆNOPTERA BOREALIS

J. Smut lith

Hambart imp

R. arvalis, let him read Pflüger's account of experiments on the crossing of the German frogs. Dissidents from the modern views on the specific distinctions of the forms of *R. temporaria* have of late become very few. That there should be at the present day a naturalist to express the opinion that *R. arvalis* is the male and *R. temporaria* the female of the same species, and a herpetologist, who professes to know European Frogs, to reproduce such nonsense with the remark "*should this discovery be confirmed it will afford an unexpected solution to the controversy,*" may appear incredible, but is unfortunately true.

APPENDIX.

The following paper, originally intended for the 'Transactions,' has been ordered by the Committee of Publications (at the request of the Author) to be printed in this part of the 'Proceedings':—

On the External Characters of Rudolphi's Rorqual (*Balænoptera borealis*). By ROBERT COLLETT, C.M.Z.S.*

[Received January 4, 1886: read February 2, 1886.]

(Plates XXV., XXVI.)

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IX. Hairy covering, p. 255.	

I. Introductory Remarks.

Although our knowledge of *Balænoptera borealis* has been considerably increased during the last few years, still almost all researches have been confined to its anatomical structure, and no complete description has hitherto been given of its external characters. Even up to the year 1882 the species was only known from a small number of stranded specimens, the skeletons of which had found their way into different museums; but of the external characters of

* [Mr. A. Heneage Cocks, F.Z.S., has kindly added some footnotes, which are designated by his initials.—Ep.]

these examples either no particulars were obtained, or at most a few scanty remarks by casual observers¹.

In 1882 a whaling-factory was established at Sörvær near Hammerfest (West Finmark) for the purpose of catching the Blue-Whale (*B. sibbaldi*), under the management of Capt. Bull. It was soon seen that the greater number of the whales caught here were the so-called "Sejhval," a species with which Capt. Bull was acquainted through his former whaling-expeditions in the Varangerfjord, but in this Fjord, as well as along the whole of the East Finmarken coast, it had only appeared casually. Eight specimens of this "Sejhval" were caught at Sörvær the first year, 1882, and in the ensuing years it was also taken, though in varying numbers. In 1883 40 specimens² were caught, in 1884 only 3, this year (1885) 44. By gradually collecting together the scattered accounts respecting this whale it soon became evident that it was a species distinct from the three other *Balænoptera*; and both Prof. Sars and I soon came to the conclusion that it might be "*B. laticeps*," Gray=*B. borealis*, Lesson, or the same species to which the skeletons just referred to belonged, two or three of which (among the few hitherto known) had been brought from precisely the same region.

Last year (1884) Dr. Guldberg, in a paper published in Bull. Acad. Roy. de Belg.¹, finally proved by the researches he had been able to make, at Sörvær, upon some parts of the skeleton (now

¹ These specimens are as follows:—

1811. One stranded in the Zuyder-Zee, Aug. 1811 (Eschricht, Kgl. D. Vid. Selsk. Skr. 5 R. 1 B.). Length 32'. The skeleton is preserved in the Leyden Museum.
1819. One stranded on the coast of Holstein in Feb. 1819, and described by Rudolphi as *B. rostrata* (Abh. königl. Acad. Wiss. Berl. 1820–21, p. 27). Length 32½'. The skeleton is preserved in the Berlin Museum.
1861. A skeleton sent to the museum at Brussels from East Finmarken (Norway) through Eschricht (V. Beneden et Gervais, Ostéographie des Cét. viv. et foss. p. 201). Length 32'.
1861. One stranded, June 1861, in Altenfjord, West Finmarken (Norway). Length of the skeleton 30' 1" (Swed.) [about 29 feet 3¼ in. English.—A. H. C.]. Described by Lilljeborg (Ups. Univ. Aarsskr. 1862, p. 25, Sver. och Norg. Ryggr.-djür, B. ii. p. 943, 1874). The skeleton is in the Bergen Museum.
1863. One stranded in Skogsvaag, near Bergen (Norway), July 1863. The skeleton not preserved. (Dr. Koren in a letter to Prof. Lilljeborg, dated Bergen, Jan. 24, 1864.)
1872. One caught in the Firth of Forth, September 1872, described by Turner (Journ. Anat. Phys. April 1882, p. 471). Length 38' (English). The skeleton is in the Anatomical Museum at Edinburgh.
1874. One stranded in July 1874, at Biarritz (Basses Pyrénées). Length 7830 mm. (25' Rhen.), and described by Fischer (Compt. Rend. 1876, tom. 83, p. 1298, &c.). The skeleton is in the Bayonne Museum.
1883. One caught on the coast of Essex, England; described by Flower (Proc. Zool. Soc. Lond. 1883, p. 513). Length about 29' (Engl.). Skeleton prepared for the Sydney Museum.
1884. One taken at Goole, Lincolnshire. Skeleton in British Museum.

² [I fancy there is some mistake about this number, and that 15 was the total of this species taken by Capt. Bull in 1883, and that 40 was his total take of all species during that season.—A. H. C.]

preserved in the University Museum at Christiania), and a fœtus from the same locality, that the Finmark "Sejhval" is identical with *B. borealis*.

Thus, whilst *B. borealis*, as has been stated, is a constant summer visitor on the coasts of West Finmark, where it has annually, although in varying numbers, occurred off Söröen, near Hammerfest, probably to gorge upon the "Aate," or the shoals of Crustacea which constitute its food, it has, as mentioned above, only exceptionally visited East Finmark, and on the coast east of the North Cape only a few specimens had been caught, and not every year.

It does not, however, appear to have been altogether unknown even on this part of the coast. During a stay in Finmark in 1878 I received information that a shoal of 13 whales, of about 40 feet in length, had stranded in a bay of the Porsangerfjord to the east of the North Cape. I did not have an opportunity of visiting the place; but as the baleen-plates of these Whales were described as being black, it seems very probable that they belonged to this species².

In the same month 5 similar small whales were stranded at Sörvær, near Hammerfest (where the above-mentioned factory had not then been established). Moreover, several whalers have informed me that this species visited the Varangerfjord in 1879 and 1880, but was not caught; they also noticed that whenever this species came in, *B. sibbaldi* left the coast and went out to sea³.

During the past summer, 1885, the Sejhval (*B. borealis*) came quite unexpectedly under land along the whole coast of Finmark, not singly or solitarily, but in such large numbers that, during the whole summer, most of the whales caught both in West and East Finmark consisted of this species. Of the other species, *B. sibbaldi*, *B. musculus*, and *Megaptera boops*, which in former years had formed the majority, only a comparatively small number were caught⁴.

Of *B. borealis* 724 specimens were caught by 18 companies stationed in Finmark, and 47 specimens by 3 companies, on the Murman coast, making together a total of 771 specimens.

In fact they were caught by all the companies along the whole

¹ "Sur l'existence d'une 4me espèce du genre *Balænoptera* dans les mers septentrionales de l'Europe" (Bull. Acad. Roy. Belg. 3^e sér. tome vii. no. 4, Avril 1884). This paper is translated (with a few additions) in Journ. of Anat. and Phys. 1885, p. 293.

² Nyt Mag. f. Naturv. 27 B. p. 260 (1885).

³ It was therefore said this year in Finmark that as *B. borealis* was under land, *B. sibbaldi* would not come, and this presumption proved to a great extent correct. *B. sibbaldi* was this year almost absent from the Norwegian coast as compared with the preceding years; but it was more common further east, as 5 whalers on the Murman coast killed almost exactly the same number of that species as all the 31 Norwegian whalers did together.

⁴ [Of *Megaptera boops* rather more examples were caught than in any previous year; this does not necessarily show that they were more numerous than in other years, but, in the absence of the two larger species, they were hunted in preference to *B. borealis*, as yielding three times the quantity of oil.—A. H. C.]

coast from Söröen, near Hammerfest, to Jarfjord in Syd Varanger, and on the Murman coast at least to Kildin.

When, during a stay in the Varangerfjord in the month of July, I ascertained that specimens of *B. borealis* were daily brought into the factories at Vardö, I at once proceeded to that place, and in the course of a couple of days I had an opportunity of examining the external characters of six specimens, three males and three females, whilst I saw double that number towed in, but want of time prevented my examining them.

Two drawings of this species have previously been produced. According to Van Beneden and Gervais (*Ostéogr. des Cét.* p. 201) the first known specimen of this whale (Zuyder-Zee, 1811) was figured, but these authors are unable to explain the fate of this figure, which never seems to have been published.

Another figure was given of Rudolphi's specimen (Holstein, 1819) in a lithograph published in Hamburg, 1819; this figure is copied in Brandt and Ratzeburg's 'Medicinische Zoologie' (B. 1. tab. xv. fig. 3); it is, however, very imperfect and confusing¹.

As our knowledge of this species is thus still very meagre, I have thought it right to give the principal results of my researches at the factories at Vardö and Mehavn this year, although I am well aware that my observations, based as they are upon only two days' studies on the spot, are very incomplete. I am also indebted to Messrs. Castberg, Bull, Bruun, Bryde, Ellersen, and Sørensen, all managers of the different factories, for communications chiefly relating to their life-history as observed during their "fishing" this year².

II. General Characters.

Compared with the three other northern Rorquals, *B. borealis* belongs to the smaller group, its length being somewhere between that of *B. rostrata* and *B. musculus*, or about 44 feet.

Its body is less robust than *B. rostrata*, more like *B. sibbaldi*, and much better proportioned than *B. musculus*.

The colour on the upper part of the body is dark grey-blue, something like *B. sibbaldi*. The belly is more or less white as far as the genitalia, but the remainder of the undersurface and also the flippers are of the same colour as the back.

The flippers are small, smaller relatively than in the other species; the dorsal fin is large, curved, and situated far forward.

The baleen-plates are black; the bristles are white and much curled, and comparatively long. In the sea the *B. borealis* may be recognized at the first glance by its large, high, dorsal fin, which most nearly resembles that of *B. rostrata*, also by its head being more slender, and its snout more rounded than are those of the other Arctic species.

¹ The colour is especially wrong, which is easily explained, as the animal was probably drawn a long time after death.

² I have to offer my best thanks to my friend Mr. Alfred Heneage Cocks for the kind assistance he has rendered me by looking over the paper before it was printed.

Measurements.

	No. 1. ♀.	No. 2. ♀.	No. 3. ♀.	No. 4. ♂.	No. 5. ♂.	No. 6. ♂.
Total length	43' (13½ m.)	43¾' (13¾ m.)	47' (14¾ m.)	44¾' (14 m.)	45½' (14¾ m.)	49' (15½ m.)
Snout to dorsal fin	28' (8½ m.)	.....	32' (10 m.)	29' (9 m.)	30' (9½ m.)	31' (9¾ m.)
Snout to flipper .....	.....	.....	17¾' (4¾ m.)	.....	14' (4¾ m.)	.....
End of flipper to flukes .....	.....	.....	26½' (8½ m.)	.....	26' (8¾ m.)	.....
Point of upper jaw to angle of mouth .....	.....	7¾' (2445 mm.)	.....	8' (2509 mm.)	9½' (2979 mm.)	.....
Point of lower jaw to angle of mouth .....	.....	9½' (2979 mm.)	.....	9½' (2979 mm.)	19½' (6¾ m.)	.....
Point of lower jaw to end of flipper .....	.....	17½' (5480 mm.)	.....	.....	.....	.....
Front of dorsal fin to flukes .....	.....	.....	15' (4706 mm.)	.....	.....	.....
Eye to axilla .....	.....	.....	5¾' (1803 mm.)	5½' (1724 mm.)	.....	1850 mm.
Point of upper jaw to nostrils	2100 mm.	.....	.....	630 mm.	.....	.....
Eye to ear .....	.....	660 mm.	.....	.....	.....	.....
Vent to anterior end of vulva .....	.....	780 mm.	.....	.....	.....	1230 mm.
Length of base of dorsal fin	840 mm.	800 mm.	.....	.....	.....	.....
Height of dorsal fin	570 mm.	510 mm.	500 mm.	670 mm.	.....	1330 mm.
Flipper (from axilla) .....	.....	1290 mm.	.....	.....	.....	380 mm.
Greatest breadth of flipper	350-350 mm.	330 mm.	.....	370 mm.	330 (L.)-380 mm. (R.)	.....
Height of body opposite middle of flippers .....	.....	.....	350 (L.)-370 mm. (R.)	.....	.....	.....
Height of body from base of dorsal fin .....	.....	7' (2192 mm.)	7¾' (2445 mm.)	.....	7½' (2348 mm.)	8' (2509 mm.)
Height of body at the middle of tail .....	.....	5½' (1724 mm.)	5½' (1724 mm.)	5½' (1724 mm.)	5¾' (1803 mm.)	6½' (1960 mm.)
Height at the root of tail .....	.....	4½' (1411 mm.)	.....	.....	.....	4¾' (1490 mm.)
Each fluke of tail .....	.....	.....	860 mm.	.....	710 mm.	.....
Breadth of each fluke .....	.....	.....	1803 mm.	.....	.....	1820 mm.
Diameter of lens	13 & 19 mm.	.....	.....	.....	.....	1110 mm.

III. Measurements.

Most of the examples caught were between 40 and 50 feet in length. The usual length was 44–45 feet or thereabouts. The largest specimens measured 52 feet¹ (16·3 metres). The 6 specimens which I examined thoroughly were 43 to 49½ feet in length (see p. 247). The last of these (a male) was considered to be one of the largest caught; so that it may be laid down as a rule that they rarely exceed 50 feet (15·6 metres).

The smallest specimens this summer that I know of were 35–37 feet, but these were exceptional. A single specimen was caught in July at Mehavn (by Foyv), the length of which was said at the place to be 32½ feet (10·1 metres).

Both sexes seem to attain about the same size; the largest female specimen that I examined was 47 feet long (14·7 metres). One of the managers stated that if there were any difference, the female was the largest and fattest, at any rate during the whaling-season.

The size appeared the same throughout the season, and it was remarkable to notice how uniform it was, and how evidently the whales were all of about the same age.

IV. Structure of the Body.

The Structure of the body seems to correspond with that of *B. sibbaldi*, which it on the whole resembles in its mode of living.

The body is highest across the middle of the flippers, where, in the case of the living animal, the height is to the total length about as 1 to 5½ (as in the case of *B. sibbaldi*). In the stranded animal, when the belly is compressed by the ground, the proportion is as about 1 to 6. The height of the body is thus not so great as in *B. rostrata*, which is at that point relatively the largest of all the four species.

The form of the hinder part of the body does not differ essentially from that of the other species. Immediately under the dorsal fin the height is one eighth of the total length, and halfway between the dorsal fin and the root of the tail one tenth. From these proportions it will be seen that in this respect it also corresponds most nearly with *B. sibbaldi*, and is neither of the exceedingly slender “emaciated” form of *B. musculus*, nor of the comparatively stout form of *B. rostrata*.

The breadth of the body can only be given approximately, and would seem across the flippers to be not very different from the height. From the vent to the root of the tail the body is strongly compressed, and the caudal part forms, as in the other species of *Balænoptera*, a thin ridge above and below, which is particularly sharp along the dorsal line. The breadth at the root of the tail at

¹ [About 54 feet English, and so with the other measurements; the Norwegian foot almost = 12½ inches English.—A. H. C.]

the narrowest point (just where the flukes commence) was in the largest specimen 390 mm., or about 15 inches.

V. Colour.

The colour of the back is bluish black or occasionally somewhat brown, much resembling the colour in *B. sibbaldi*, although the blue colour as a rule is less pronounced than in that species. The colour after death is darker than in the living animal. On the side of the body the colour becomes somewhat lighter; the belly is dark steel-grey with a white area running along the centre; the white colour begins at the symphysis of the lower jaw, and terminates at the genitalia, but occasionally it is interrupted or imperceptible on the middle portion of the belly.

Considerable variations occur in the breadth, size, and form of this white part of the belly. The throat is always white, occasionally throughout its entire breadth, sometimes only for a couple of feet. On the breast the white becomes narrower, and in many individuals is completely cut off by the bluish-grey colour of the sides, but it then reappears on the belly, and continues in a somewhat irregular width to the genitalia. Behind the vent the whole underside of the tail is light bluish grey, about the same as the back.

The white colour is not always symmetrical, but is occasionally broader on one side of the middle line than on the other; also the extent of it on the belly may be rather irregular. On the throat similarly the white colour is sometimes broader on one side than on the other.

The white patch on the belly was never absent in any of the specimens examined; and this observation is confirmed by all the managers of the whaling companies, who state that it is always to be found, though it is sometimes only slightly developed.

The white colour, especially on the throat, is pure and sharply defined. On the belly and in front of the genitalia there are, on the contrary, a large number of very fine bluish-grey lines, which are quite short and run parallel to each other; these lines, which can only be distinguished when you are near to the animal, sometimes, when they are very numerous and closely set, detract from the whiteness of these portions.

The flippers are coloured on the outer side like the back; on the inner side they are a trifle lighter, especially along the lower edge: a few individuals (such as No. 2 of the specimens examined) have large whitish spots on the inner side; these are never, however, absolutely white. The flukes of the tail are also bluish grey underneath; the dorsal fin is exactly the colour of the back.

Distributed over the dark parts of all the specimens examined were a greater or less number of whitish oblong spots of peculiar form and colour, their length being about 100 mm., and breadth about 30 (Plate XXVI. fig. 2). Their outer edges are not always sharply defined; their colour is in general whitish grey, occasionally almost white, and more rarely dark grey. Along the centre of the

long axis there runs a dark line, from which to both sides and both ends run fine radii of similar lines¹.

These patches are most frequent on the sides of the body somewhat below the middle, and occur also on the tail, but may be found, when they occur to any great extent, distributed singly right up the centre of the back, and extending as far as the end of the lower jaw. They occur on all examples, although they may not be equally apparent in all. They evidently are due to a peculiar matter in the skin, as they become more perceptible after the animal has dried for a time. Single small white spots of a normal form occur less frequently in the black portion of the sides, especially up towards the back.

Among the markings of less constant occurrence may be noticed:—On one of the specimens examined there was a slightly lighter patch behind the ear-opening, which began just at its posterior margin, and extended backwards in a pyramidal form for about a foot.

In order to show the variations of the white colour on the belly, I shall briefly explain its extent in the individuals examined by myself.

No. 1. *A female*.—Throat entirely white; on the breast the white area became narrower, though without being completely broken off. A larger white patch occurred at the end of the furrows, forming here an extension of the central stripe. On the belly the white colour was partly covered over by the fine light bluish-grey lines, which terminated as single white stains at the mammæ.

No. 2. *A female*.—The white area symmetrical and ample; throat white, about ten furrows on each side being included, though the upper ones were spotted with black.

The patch became narrower backwards, so that between the flippers only three furrows on each side were included, while behind the flippers it spread out in an anchor-like form, the arms of which extended rather high up on the sides (and to about half a flipper's length from the end of the flipper).

Behind the furrows the white area was almost interrupted by the grey colour of the sides, but widened out again in front of the mammæ, where it was whitish and not sharply defined. The fine bluish-grey lines were most frequent towards the dark portions of the sides.

In this specimen the oblong whitish marks on the sides were comparatively few and indistinct, although some of them were perfectly white.

No. 3. *A female*.—Throat white, the white commencing just behind the symphysis of the jaw, and including the eight furrows on each side of the central line; this white portion diminished as it passed backwards. Almost exactly under the distal end of the flipper, when lying parallel to the body, it was broken off by the colour of the sides, but it recommenced at the navel, and thence extended unbroken to the mammæ.

¹ The general form and design reminds one of the septa in a *Fungia* or *Herpetolithus*.

The oblong whitish marks occurred all over the animal, from the beginning of the flippers to the root of the tail, but did not, generally speaking, extend much higher than the middle of the sides; several small spots, however, of normal form occurred up towards the back.

In this specimen the underside of the flippers had large whitish spots.

No. 4. *A male*.—Unusually dark. The white colour was comparatively little extended, as in front it embraced only four furrows on each side, and even here was mixed with black. Backwards the white colour widened somewhat, so that six furrows on either side were included, though with black stripes from the sides extending obliquely into them. Behind the furrows the central patch was terminated by the colour of the sides, and there was but little white in the portion in front of the genitalia.

In this specimen were noticed a large number of the peculiar oblong marks, some quite white, most of them, however, darker in hue, spread over all the dark parts of the belly, extending both downwards to the white stripe and upwards on to the back. They were most numerous about the middle of the sides and on the posterior portion of the body.

No. 5. *A male*.—Throat white, extending over eight furrows on each side, from the front to between the ends of the flippers. Above these, six furrows on each side were mottled with white.

Further back the white part was interrupted, so that the belly behind the furrows was, for a short distance, of a uniform blue-grey tint like the sides, but again became whitish, sprinkled over with the narrow bluish lines as far as the genitalia. The oblong whitish marks were present, especially on the sides.

No. 6. *A male*.—Colour almost similar to that of No. 2, the white having almost exactly the same extent. Here also the white patch between the flippers extended in a somewhat irregular anchor-like form. Behind the furrows the white was almost terminated by the bluish-grey colour of the sides; it recommenced at the navel and extended to the genitalia, but was pencilled over evenly by fine short grey lineolæ. The oblong whitish marks were numerous, tolerably light-coloured, but none quite white, and extended almost to the end of the lower jaw.

In a 7th specimen, which lay secured in the water with the belly exposed, the white colour was more decidedly asymmetrical than in any of the others. On the breast the white included six furrows on the right side, whilst the whole of its left side was black¹.

The white area extended as usual to behind the end of the flippers, where it became narrow or disappeared, but extended again backwards to the genitals, and at this point it was symmetrical on the two sides.

¹ A similar asymmetry of colour (left side dark, right side white) has been noted on two occasions by Professor Sars as pervading the lower jaws in *B. musculus* (Forh. Vid.-Selsk. Christiania, 1878, no. 15, p. 9; 1880, no. 12, p. 3). [A similar specimen was recorded by me in the 'Zoologist,' April 1885, p. 138.—A. H. C.]